

STATEMENT OF

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before the

U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

HEARING

on

PROPOSED OIL AND GAS LEASING

on the

OUTER CONTINENTAL SHELF  
NORTHERN GULF OF ALASKA

ANCHORAGE, ALASKA  
AUGUST 12 - 13, 1975

My name is Guenter M. Conradus. I am employed by Mathematical Sciences Northwest of Bellevue, Washington as a Senior Economist.

In January of 1975, Mathematical Sciences Northwest, Inc. was requested by the Gulf of Alaska Operators Committee to undertake a study of the economic and social impacts which would be felt in Alaska as a whole and specifically in six coastal communities (Juneau, Yakutat, Cordova, Seward, Whittier, and Kodiak) as the result of likely exploration, development and production activities on the outer continental shelf in the Gulf of Alaska. I directed that study.

I had earlier directed a number of economic and social impact studies of, for example, the construction and operation of new or expanded oil terminal facilities in the Puget Sound waters of Washington (for the Oceanographic Institute of Washington) and the construction and operation of four nuclear power plants in the State of Washington (for the Washington Thermal Power Plant Site Evaluation Council).

Prior to returning to the private sector in 1972, I taught undergraduate and graduate economics at Occidental College and San Jose State University. I also taught at the University of California, Los Angeles and the University of Southern California, on a part-time basis.

Over the past twelve years, I have consulted for a number of public agencies and private corporations in matters relating to the economics of growth and change and resource taxation.

The study for the Gulf of Alaska Operators Committee was completed in May of 1975, and in the months of June and July members of the Gulf of Alaska Operators Committee and I briefed officials of the Alaska state government,

the Mayors and members of the Cities Councils of the cities of Yakutat and Cordova, the President and members of the Yak-tat Kwaan Native Corporation in Yakutat, the President of the Eyak Native Corporation, representatives of the Cordova fishermen's union, Alaska state legislators and their staff, and members of the news media.

Copies of the study have been made available to a large number of interested public and private bodies, among them the Alaska state government, state legislators, the Outer Continental Shelf Office of the Bureau of Land Management, the Federal Energy Administration, the Mayors of the six most likely impact communities, environmental groups, and representatives of the news media.

A summary of our study has been prepared by me and will be submitted for the record.

After the study was completed, I spent more than three weeks in England, Scotland, the Shetland Islands, and in Norway. I there talked with government officials, local and regional planners, academicians, fishermen and representatives of some of the oil companies which operate in the North Sea.

This is obviously not the place nor the time to comment at length on both my findings and the impressions I gathered.

The one overwhelming impression I brought back is that the local authorities, both at the city and county levels, with the active cooperation of the oil companies and their contractors, have been able to effectively plan for the onshore development related to support bases, platform construction sites, terminals, gas separation plants, pipelines, and tank farms, thereby minimizing any adverse social and economic effects.

The Economic and Social Impact Study of Oil Related Activities in the Gulf of Alaska was undertaken by Mathematical Sciences Northwest, Inc. (MSNW) at the request of the Gulf of Alaska Operators Committee (GOAOC).

The study addresses the likely economic and social impacts of oil and/or gas exploration, development, and production activities following the first sale of leases on the outer continental shelf (OCS) in the Gulf of Alaska. The impact areas are the "Gulf of Alaska" and "Other Alaska". Within the "Gulf of Alaska" area which includes Anchorage, six coastal communities have been identified as potential primary impact sites, serving as onshore support bases for offshore activities or as transshipping points for the expected future hydrocarbon output of the yet to be discovered fields. The coastal communities are: Juneau, Yakutat, Cordova, Whittier, Seward and Kodiak. (See attached map). The study period is 1976 to 1985.

Since no one knows with any precision what the quantities of proven and recoverable reserves of oil and gas in the lease area are, and since the rate(s) of recovery are also unknown, certain assumptions had to be made. For the base case, the most important assumptions are:

- Exploration activities commence in 1976, leading to the discovery of the first field in 1977.
- A total of five fields will be discovered.
- Each field will ultimately support three production platforms, for a total of fifteen.
- The peak average daily production from all fields will sum to 550,000 barrels/day.

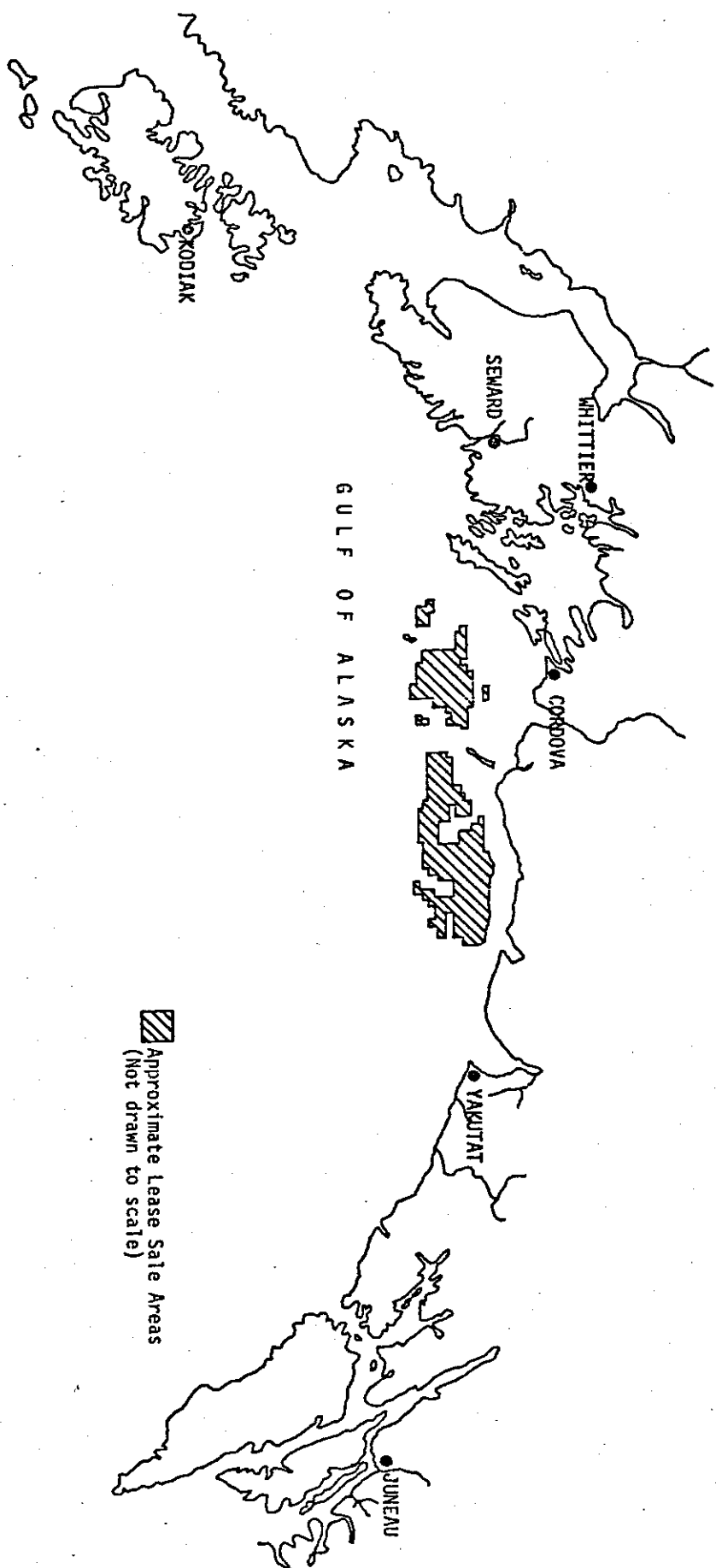


FIGURE I-1: IMPACT COMMUNITIES IN THE GULF OF ALASKA AND  
APPROXIMATE FIRST LEASE SALE AREAS

- Two pipelines will be constructed to transport the crude to two onshore transshipping terminals.
- Two permanent onshore bases will support the offshore activities during the exploration, development and production phases.

The economic impacts of the oil and gas related activities all emanate from the additional employment generated. Based on data supplied by the GOAOC, the direct employment was estimated to be 291 persons in 1976, the first year of activities, build up to a peak of 1,486 persons in 1980, and gradually decline to 886 persons in 1985.

The incremental onshore indirect and induced employment in such sectors as construction, wholesale and retail trade, finance, insurance, and real estate, and state and local government, for example, was also calculated. In fact, three calculations were made, using an employment multiplier of 2.0, 1.86, and 1.46 respectively. Given a multiplier of 1.86 (thought to be applicable to the geographic areas under consideration), the indirect and induced employment generated by the primary hydrocarbon activities will number 541 persons in 1976, 2,764 in 1980, and stabilize at 1,648 in 1985. Thus, the total employment generated and attributable to the new OCS activities in 1976, 1980, and 1985 sums to 832, 4,250, and 2,534 persons respectively.

While many of the workers who will be employed in the primary activities such as exploration and development drilling and the offshore construction of platforms are likely to be brought to Alaska from other parts of the United States, significant additional employment opportunities in the secondary

sectors will be created for Alaskan residents. Persons presently employed in the construction of the Alyeska pipeline, for example, will be able to transfer their skills to the construction of support bases and transshipping terminals as work on the pipeline winds down. Fishermen can operate supply boats in addition to or instead of their usual occupation (if the Alaskan Limited Entry Program prevents their continuing as fishermen). The induced onshore activities will not only offer additional employment opportunities but are also likely to offer jobs at different and higher skill levels.

In addition to using an economic base model to estimate the future employment (and population) effects, an input-output (I/O) model was constructed. The implementation of the I/O model on a computer permitted the calculating of the direct and indirect employment, income (wage), and output effects of a number of alternative oil development schemes, which differed from the basic assumption of a peak production of 550,000 barrels/day from five offshore fields. The nine basic alternatives which were considered ranged from unsuccessful exploration ending in 1980 without any further activities in the lease sale area, to the discovery of ten fields producing 1.5 million barrels/day and the construction and operation of 10 pipelines to shore and three onshore facilities. Using the I/O model also made it possible to make assumptions about the ability of the Alaskan economy to expand in real terms (15, 30, and 100 percent per year respectively), and to calculate the resulting employment, income, and output effects. Thus, in all, 28 separate oil development and real growth combinations were considered and their economic impacts calculated.

Assuming that from five offshore fields the peak production reaches 600,000 barrels/day, for example, the total (direct and indirect) additional

wage earned in the impact areas amounts to \$9.6 million in 1976, peaking at \$44.3 million in 1981, and stabilizes at \$29.5 million in 1985. If the wage and salary incomes earned in the rest of Alaska are added (\$5.0, \$14.8, and \$16.7 million in 1976, 1981, and 1985 respectively) the total direct and indirect incremental wage and salary payments to persons working in Alaska due to the oil and gas activities would amount to \$14.6 million in 1976, \$59.1 million in 1981, and would stabilize at \$46.2 million in 1985.

The state's production of goods and services will, of course, also increase. Abstracting from the direct values of the oil related facilities and the oil itself, which are enormous, the value of the output of goods and services induced by the primary activities also increases significantly. It is estimated to be \$22.9 million in 1976, \$79.8 million in 1981, and \$87.1 million in 1985.

The additional personal and corporate incomes earned, the value of the additional output of goods and services, and new plants and facilities will provide new state and local tax bases. Several factors made it impossible to estimate the tax revenues accruing to state and local governments. It was not clear what the effective rate of taxation of incomes earned by a temporary workforce would be. The definition of taxable corporate income earned from offshore activities and the effective rate of taxation applied to it were also unknown, as was the value of the onshore plant and equipment subject to state and local property taxation.

The additional economic activity induced by the hydrocarbon development and production not only creates additional employment but also causes the temporary and permanent populations of the impact communities and the rest of

Alaska to grow. A larger population requires an absolutely larger quantity of goods and services. Some of these will be supplied by the private sector. Others, however, require public investment. It is not only important to determine what the absolute quantities of goods and services (public and private) demanded will be, but the points in time when they must be available must also be known, in order to assure that the quantities and qualities of services available to the present population in the impact areas are not diminished by a sudden surge in the demand for them by an immigrant population.

Using the base case of peak petroleum production of 550,000 barrels/day once more, the maximum total population changes in Alaska (assuming all new jobs are filled by immigrants), are 1,396 persons in 1976, peaking at 7,232 in 1980, and leveling off at 4,426 in 1985. This additional population will be distributed throughout Alaska however. The permanent OCS induced population increases in one or more coastal impact communities (most likely Yakutat and Cordova, because of their proximities to the lease areas), are estimated to be 59 persons in 1976, 700 in 1980, finally reaching 1,302 in 1985.

The assumptions underlying the estimates of the permanent population increases in the coastal communities are:

- 15 percent of the Alaskan component of the workforce employed during the exploration and development phases will live in the coastal communities.
- 30 percent of the workforce employed during the production phase will live in the coastal communities.

- The employment multiplier is 1.86.
- The dependency ratio is 2.04.

Additional public services must be supplied to this population. Some public services will also have to be supplied to at least a percentage of the new temporary population which will reside in the impact areas during the exploration and development and construction phases. In addition, public services will have to be available to those new immigrants who are drawn to the areas by the expectation of obtaining employment.

A major issue is housing. Assuming that 0.81 housing units are required per member of the permanent labor force (the 1970 Alaskan state-wide average), 23 additional housing units must be available in 1976, a total of 277 units in 1980, and 516 units in 1985. Since none of the coastal communities do at present have any appreciable number of vacancies, these housing units must be newly constructed, or that segment of the workforce which was assumed to take up permanent residence in the coastal communities will have to be transported to the sites from other Alaskan or lower 48 cities.

Other issues addressed are:

The permanent school population in the impact areas will also grow, from 8 students in 1976, 91 in 1980, to 160 in 1985. Depending upon the communities in which this school population finally settles, some, or possibly a significant amount of additional investment will have to be made in fixed facilities.

Because the communities have virtually no excess capacities, investments in a number of other public sectors will also be required. Additional water and sewage treatment as well as solid waste disposal facilities must be provided.

Since none of the communities are presently equipped to handle major medical problems of the existing population, medical facilities and staff must be added.

In order to assure the public safety, more peace officers and fire-fighters will be required and more equipment and facilities are likely to be demanded.

Additional social capital and professional manpower attracted to the impact sites are likely to benefit both the present resident as well as the newly attracted population.

In all of these public employment categories, wage rates may have to be increased above current levels if the public sector is to compete effectively in labor markets stimulated by the OCS induced activities.

The quantity and range of indoor recreational opportunities must be enlarged.

Finally, given the significant projected increases in the population of the likely coastal impact communities relative to their present sites, and assuming reliance on the automobile, the surface transportation, e.g. roads, parking lots, etc. must be expanded.

It is unlikely that the coastal impact communities, individually or collectively, have the fiscal resources to make the necessary public investments (well in advance of the time their output is actually demanded) to assure that no bottlenecks develop.

After the lease sale has taken place and the impact communities requiring additional public and private investment have been identified, federal, state, and private investment funds must become available. The

magnitudes of the necessary social and private investment programs are a function of the level of exploration activities and ultimately depends upon the discoveries made and the rate of production of oil and/or gas. Equally, if not more important than the availability of financial resources for public and private investment, will be the existence of local and state planning processes which allocate the investment resources. At present, neither the likely impact communities nor the state or federal agencies (in Alaska) appear to have any or adequate staff to effectively deal with the OCS related issues. Therefore, state and local planning agencies should be established to permit the rational planning of offshore and onshore developments and in advance of making the necessary public and private investments.

The OCS induced activities will bring about economic and social changes in Alaska. These changes will be more noticeable in the smaller coastal communities than, for example, in Anchorage or Juneau. Because some major activities, such as the construction of platforms, will not take place in Alaska (in the foreseeable future), the aggregate impacts in Alaska will be relatively smaller when compared with impacts observed in North Sea coastal communities of the United Kingdom or Norway.

Nevertheless, some individuals or firms may incur economic and social costs. It is likely, for example, that competition for labor among employers will push up wage rates, increasing the cost of production of public and private goods and services. Those individuals who, at present, have adequate incomes in the form of money and tranquility which affords them a certain "Lifestyle" may consider the reduction of the latter as both an economic

and a social cost, even if their money incomes increase. On the other hand, the likely economic benefits, both for Alaska and the U.S. as a whole, are significant. The expected value of the hydrocarbon output is enormous. The national importance of its physical availability is obvious. The macro-economic benefits for Alaska will take the form of increased long-run employment opportunities, increased wage and salary incomes, and an increased tax base. At the micro level, an increase in the size of local markets may increase both the quantity and quality of public and private goods available to all segments of the population.

U. S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

HEARING ON PROPOSED LEASING IN THE GULF OF ALASKA

Ladies and Gentlemen:

I am Joe W. Tyson, Senior Scientist for the Gulf Universities Research Consortium (GURC), now Houston, Texas. I am appearing today on behalf of GURC at the request of the Gulf of Alaska Operators Committee.

As some of you may know, GURC is a research oriented organization which counts in its membership 20 universities with interests in the Gulf of Mexico.

During 1972-1974, GURC, at the request of a number of SLIDE #1 companies, initiated its Offshore Ecology Investigation to answer the deceptively simple question; "what is the measureable impact of drilling for oil, and later producing it on the estuarine and marine environment of the Louisiana outer continental shelf, the nation's greatest offshore oil producing region?" After an intensive study costing more than 1½ million dollars, the conclusion reached by GURC is that the drilling and subsequent production of petroleum products off of Louisiana has had no major lasting adverse affects on the marine environment and may even have been beneficial to some life forms.

In appearing here today, I fully realize that the Gulf

of Mexico is not the Gulf of Alaska, and that there are significant differences between the two areas. Nonetheless, we believe that the results of our studies must be given serious consideration whenever offshore leasing is proposed. This is because the GURC offshore oil investigation is by all odds the most thorough and comprehensive study of the environmental effects of offshore drilling and production yet undertaken.

Based upon the data analyses thus far, several general conclusions can be reached from this comprehensive Offshore Ecology Investigation:

1. It questions the universal necessity for conducting a "before-the-fact" baseline study to subsequently determine the environmental impact of this type of man's activity.
2. Natural phenomena such as seasonality, floods, upwellings, and turbid layers have much greater impact upon the ecosystem than do petroleum drilling and production activities.
3. Concentrations of all compounds of OEI interest which are in any way related to drilling or production are sufficiently low to present no known persistent biological hazards.
4. Every indication of good ecological health is present. The region of the sampling sites is

a highly productive one from the biological standpoint, more so than other regions thus far studied in the eastern and open Gulf of Mexico.

5. Timbalier Bay has not undergone significant ecological change as a result of petroleum drilling and production since just prior to 1952 when other more limited data was generated.

The accuracy of the conclusions reached on any such scientific study are, of course, dependent upon the validity of the procedures and the accuracy of various tests and measurements. Therefore, the procedures and equipment used in this study will be discussed in some detail in this presentation along with the most important of the factual data and results.

The biological, chemical and physical experiments to be performed were designated and sites were selected in Timbalier Bay, Louisiana, and in the offshore area to depths of about one hundred feet of water (shaded in red). Sampling stations adjacent to drilling or production platforms and control sample stations in areas where there has never been oil drilling or production are within the same region, thus making possible valid comparative studies. All sampling stations are located far enough from the Mississippi River mouth to uniformly minimize, but not eliminate, its impact.

A low elevation aerial oblique view of the region shows

the natural relationships between the Continental Shelf, SLIDE #8  
the narrow beach, and the inner bay.

Platforms, both for drilling and production; are quite  
dense in this region between Timbalier Island and Casse-tete SLIDE #9  
Island.

This platform just west of Philo Brice Island in Tim-  
balier Bay was one of the intensive sampling sites with sam- SLIDE #10  
ple stations being located in a radial pattern outward from  
the platform.

The density of platforms and wells offshore is some-  
what less, than in the bay, although recent figures indi- SLIDE #11  
cate there are some 2,650 platforms in the northern Gulf  
of Mexico. Because of the intensity of petroleum presence  
and production, there has been and is oil in this environ-  
ment -- whether as a result of natural seeps, spills, or  
whether as a result of overboard discharge of brine contain-  
ing a few parts per million of petroleum hydrocarbons or  
from other sources as city wastes, seagoing ships, sports  
boats, and the plants and animals living in the environment.

A working platform makes many contributions to the en- SLIDE #14  
vironment in addition to its physical presence. You will note  
that among the potential contributions from the platform are  
nutrient (food) materials from treated sewage, garbage, brine  
containing small amounts of petroleum hydrocarbons, trace  
elements from corrosion protection devices, and other kinds of

compounds as well as a habitat for plants and animals. The sampling program was designed to determine which of those are present and, if present, their locations and concentrations.

GURC scientists visited the platform and control stations as indicated by this sample station map. Timbalier Bay had 224 stations, enough to allow any existing gradients to be established. There were 115 stations offshore and along transects or lines drawn from the platform and control sites to shore-based stations. All field equipment was regularly calibrated against available appropriate standards (both external and internal) to allow comparative correlations to be made from one field trip to the next. There were four seasonal 8-to-10-day trips each year for the two years by the group plus many other shorter trips by individual scientists. All of the sampling stations were occupied on each seasonal trip, as well as at other times by either the 23 scientists or some of the more than 30 graduate students involved in the program -- many of whom were diving scientists.

The largest number and volumes of samples collected were water samples taken at the surface, at mid-depths and very near bottom to determine oceanographic information such as salinity, temperature and nutrient and trace element chemistry. Fractions were analyzed for total carbon and organic carbon. For these kinds of analyses, relatively

small volumes of water are required; allowing utilization of the Sampling Bottle shown.

Large volume samples were required for the determination of the specific classes of hydrocarbons in the water mass. Therefore, this large volume sampler was used so enough water would be acquired to permit the detection and characterization of hydrocarbons. SLIDE #19

Plankton nets were used in order that the mainly microscopic floating plant and animal life could be caught and studied. From samples captured by the Plankton nets the scientists were able to determine, as a function of carefully measured volume, the nature of the living things floating in the water, their diversity, their effective weight by species, and their hydrocarbon types and amounts. SLIDE #20

The bottom grab sampler takes approximately 1/3 of a cubic yard of sediment each time it is lowered. These sediment samples were required for sediment analysis and to catch the bottom dwelling plants and animals (benthos). Some bottom grab samples as well as short sediment cores were collected by divers. SLIDE #22  
SLIDE #23

Evidences of drill cuttings and muds were sought at every sampling station and were found by divers only once and in very small quantities near a platform leg. These cuttings could not be associated with an adverse impact. SLIDE #24

It was mentioned earlier that water samples were taken SLIDE #25

to allow for the determination of dissolved mineral nutrients. Nutrients enter the living processes in plants and animals and are, therefore, often early affected by materials introduced into the environment. The extent of dissolved mineral nutrients then is an indicator of environmental impact. Here, onboard scientists at the sampling station are splitting the water samples for chemical analysis.

Crude oil will float temporarily at the surface, forming a filmy sheen. To determine the quantities and fate of these petroleum hydrocarbons, it was necessary to sample the thin floating film. Project scientists developed this sampler that would allow them to take a reproducible standard sample and relate the results of chemical analyses to the volume and area that had been sampled.

The sampler was lifted aboard the research vessel where the adsorbed oil and other materials were carefully washed into previously cleaned containers. Scrupulous care was taken to insure that no contaminants (such as lubricating oils) get into the sample during the transfer process.

In university laboratories, the biological samples were positively identified, counted and weighed so that comparisons were possible from place to place on a seasonal basis.

Some of the laboratory activities required highly sophisticated and massive equipment such as these views of hydrocarbon chemistry laboratories and gas chromatograph and

mass spectrometer equipment linked to computers. Such a link makes comparisons possible between samples collected during the project and calibrated standards and permits identification of separate compounds present. Furthermore, selected animals and some uppermost sediment samples were analyzed to determine their hydrocarbon content.

That active oil drilling and production operations do SLIDE # 3 sometimes result in release of hydrocarbons is demonstrated by this infrared image showing drilling platforms and a temporary hydrocarbon sheen resulting from their activities. In the center of the view, a one molecule-thick layer of crude oil shows as a lighter blue area stretching between the two rigs. The reddish areas that you see below are marsh grasses onshore nearby as they appear on infrared film.

The occurrence of other fresh crude oil on the surface SLIDE #32 of the water gave the scientists an opportunity to conduct field studies on its behavior and fate in the marine environment, so this small floating patch was observed for several days.

After twenty-four hours, the appearance of the same oil had changed. Evaporation of some less complex hydrocarbons SLIDE #33 and microbial and chemical degradation of the oil was relatively advanced. It will be noted that the oil has begun to emulsify and clump.

In order to follow the process and rate of breakdown of the oil under more controlled conditions, experiments were SLIDE #34

conducted in the laboratory. Flasks were inoculated with both locally produced oil and bacteria found in the area. Here on the left, you will note that initially the oil is floating on the surface of the seawater with very few globules and very little clumping. On the right, 24 hours later, bacterial and chemical action has substantially degraded the crude oil; clumping is very far advanced; and much of the material has been converted by bacteria into foodstuffs and byproducts.

In order to better identify and count these bacteria, SLIDE #35 seawater was placed on suitable materials in shallow plastic dishes using standard microbiological techniques. Here, particularly under the number 14, you see several small, white, glistening colonies of individual kinds of hydrocarbon-degrading bacteria isolated from the study area, and, in the same numbers, from other control areas in the Gulf of Mexico.

These experiments indicate that physical and bacterial processes rapidly degrade oil films with the result that there are extremely low amounts of hydrocarbons (average: 5 parts per billion) found in the water.

There was a definite lack of concentration or build-up of any specific hydrocarbon molecule. Similar results were shown by mass spectrometer analysis of the oil on the surface of the water and samples taken deeper in the water.

The major components of the Gulf of Mexico ecosystem SLIDE #16 are the phytoplankton, the mainly microscopic floating plants.

These are the primary producers of the sea that convert carbon dioxide, minerals, and water to starches and sugars, protoplasm and other chemical compounds by photosynthesis. They are eaten by the next level in the food web, the zooplankton which include numerous types of mainly microscopic animals. The nekton are those free-swimming animals found in the environment such as fish and squid. The benthos are the bottom dwellers, some attached and some capable of burrowing in the sediments.

Several aspects of the food cycle and ecosystem were studied in the Offshore Ecology Investigation. Some of the aspects studied were the total mass and diversity of living material present and the distributions of living plants and animals. The results of these investigations showed that there are no differences solely attributable to geographical location except for populations living on platform legs. In other words, except for increase in the populations of certain life forms, the presence of man and petroleum production has had no major effect on the total mass and diversity of living material. Because all life forms are sensitive to their environment, the seasonal changes in both temperature and chemical nature were studied in detail. By the end of the study, the project biologists were able to show that these seasonal variations were far more significant than any other variations, including proximity to oil producing areas.

One sensitive measure of the gross productivity of the SLIDE #37 phytoplankton community is the presence and amount of chlorophyll, the green substance of plants which allows conversion of simple compounds into complex food materials. It can be seen on the slide that there were significant seasonal changes in chlorophyll content reflecting the total populations of floating microscopic plants.

Associated with changes in this floating plant community SLIDE #38 were seasonal changes in the floating animal community, the zooplankton. It can be seen that these seasonal changes follow the seasonal change in chlorophyll.

The bottom dwelling community is of great import in SLIDE #39 the ecosystem. It is this community that receives the "rain" of food that sinks down from above. Many of the benthos are filter feeders that therefore take surrounding water through their bodies and remove particulate matter and phytoplankton from the water as food. Others obtain nutrients from sediment passed through the digestive tract. It will be noted that the seasonal changes in this community greatly exceeded the differences between a site of man's activity and a control site where there was no such activity.

Because the reef effect of platforms is so important, SLIDE #42 the study of the living things found on their legs deserves further attention. Every solid surface is colonized and becomes a reef. Platform legs here supported about 6½ pounds

of living things per square yard of surface area, more than any natural "surface" in the study area.

As one begins at the surface of the water and goes SLIDE #43 downward to the bottom of a platform leg, the simplest of plants, the algae, which are also near the bottom of the food web, grow only in shallower depths where light can penetrate. The net effect of the growth on platform legs is to increase the available food supply for animals higher in the food web because these plant materials are grazed by smaller fish, snails and other animals which are fed upon, in turn, by the species sought by man.

To investigate growth rates, the platform leg on the SLIDE #44 left, had been scraped to the bare metal some 45 days before the photograph was made. It is easily seen that recolonization is rapid. On the right, the large white patch is a colonial animal form called Bryzoa.

Here, both barnacles and hydroids (other animal forms) SLIDE #45 are seen growing together. As colonization develops with time, there is both an increase in and a complexity of living things as well as an increasing competition for the available space. The hydroids are overgrowing the barnacles.

From the fish catch, shrimp catch, and oyster harvest SLIDE #48 data shown plotted here with oil production through the years in this region of Louisiana, it can be seen that these catches of commercial importance have not decreased as oil production

has increased; they have indeed increased. This is not to say that increase in catch is the result of industrial activity; however, it is certain that catches have not suffered while oil drilling and production have increased greatly during the same years.

"In conclusion, ladies and gentlemen, let me state that SLIDE #4 I appreciate the opportunity to appear before you today to report on the results of our Offshore Ecology Investigation. Based on this study and other less inclusive with which I am familiar, it appears that there are no significant long-term adverse effects resulting from offshore petroleum operation. In light of this evidence, and considering the critical need for the energy resources of the Gulf of Alaska, all factors appear to argue in favor of the holding of the proposed sale.

Joe W. Tyson  
SENIOR SCIENTIST  
GULF UNIVERSITIES RESEARCH CONSORTIUM

STATEMENT OF  
WILLIAM F. GUSEY  
COORDINATOR, ENVIRONMENT AND BIOLOGY  
STANDING COMMITTEE  
GULF OF ALASKA OPERATORS COMMITTEE  
BEFORE THE HEARING OF  
THE U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
ON  
ENVIRONMENTAL IMPACT OF PROPOSED OIL AND GAS  
LEASING-OUTER CONTINENTAL SHELF, GULF OF ALASKA  
(OCS SALE NO. 39)  
AUGUST 12-13, 1975  
AT ANCHORAGE, ALASKA

Gentlemen:

My name is William F. Gusey. I am the Senior Staff Wildlife Specialist in the Environmental Affairs organization, Shell Oil Company, but am appearing here today as the Coordinator, Environment and Biology Standing Committee, Gulf of Alaska Operators Committee. A copy of my curriculum vitae is attached to my statement.

Within the Gulf of Alaska region, fish and wildlife resources are essential to the overall recreational program of the state and contribute substantially to the economy of the state. Time does not permit an adequate discussion of these resources at this point. However, we are submitting a detailed statement entitled, "Fish, Wildlife and Petroleum Production - The Gulf of Alaska," dated August, 1975. We ask that this statement and the following appendices be made a part of the record of this hearing.

Appendices 1 to 5, a 524 page document (2 volumes) describing the fish and wildlife resources of the Gulf of Alaska.

Appendices 6 to 8, a 227 page document of supplementary fish and wildlife data, which discusses existing petroleum industry experience and the resources of the Gulf of Mexico, Santa Barbara Channel and Cook Inlet; the National fishery situation from 1939 to 1974, as applicable to fishery trends where the petroleum industry currently is and is not operating; and Gulf of Alaska demersal fish and shellfish distribution and abundance data for the period 1950 to 1971.

On behalf of the Environment and Biology Committee of the Gulf of Alaska Operators Committee I want to express our appreciation for the generous responses we received to our many requests for data from many individuals in the Alaska Department of Fish and Game; National Marine Fisheries Service;

surfaces provided by oil platforms. Encrusting organism also thrive on these surfaces.<sup>(1)</sup>

Thus, the reef effect of offshore platforms, like other artificial reefs, is an ecological asset. The abundant fish around such structures is well known in the Santa Barbara Channel and in the Gulf of Mexico. These platforms serve as artificial reefs where major fish populations are concentrated. In the Gulf of Mexico this feature of platforms has been instrumental in the development of a substantial sport fishery off the Louisiana coast.<sup>(2)</sup> Whether or not this will be a measurable value in the Gulf of Alaska will be determined only on the basis of sport fishing demand.

In the Gulf of Alaska, we believe that mid- and upper-water pelagic fish will orient to platforms, some strongly, with numbers dictated by seasons and available food. Studies by the National Marine Fisheries Service (Klima 1970),<sup>(3)</sup> revealed that certain Gulf of Mexico open water species such as sardines, menhaden, and jacks were attracted in great numbers to small structures positioned about 50 feet below the surface. In excess of 10,000 fish were attracted in one day and upwards to 100,000 after only seven days.

Diver observations in the Gulf of Mexico indicate that commercial quantities estimated at up to 25 metric tons of fish were attracted to an artificial structure on one occasion, and, on six others, at least 5 metric tons were attracted during a 20-day study.<sup>(3)</sup> It is questionable that this will occur with strongly migratory fish such as salmon.

3. The effect of offshore platforms in reducing the fishable sea floor is yet to be examined, but in terms of fishery harvests, is probably statistically insignificant.

by the Bureau of Land Management for this Gulf of Alaska lease-sale. In addition, seal populations exist near several coastal locations which may be considered as potential crude oil terminal sites. These include populations at Yakutat Bay, Icy Bay, southern end of Kayak Island, and the northern end of Montague Island.<sup>(6)</sup>

Abandonment of harbor seal pups by their mothers is a common occurrence, particularly if they are disturbed by hunting or other activities of man, including aircraft and boat traffic. The seriousness of this reaction as a function of seal populations in the immediate vicinity of terminal sites cannot be fully evaluated at this time. Seals will vacate any shoreline area which is greatly modified by construction and followed by intense industrial activity. Measures to mitigate these effects will have to be determined on a site-by-site basis. On the other hand, seals may continue to occupy previously utilized beaches or rocks some distance removed but in the general area of a shore facility, i.e., one mile.

#### Steller Sea Lions

Significant sea lion concentrations have been identified at seven points along the perimeter of the area offered for an OCS lease sale.<sup>(5)</sup> Five of these concentrations are in the vicinity of sites which could be used as crude oil terminal sites. These include populations at Sitkagi Bluffs at Yakutat Bay, Kayak Island, Seal Rocks and Porpoise Rocks off Montague Island, and at Fountain Rock off Middleton Island.<sup>(6)</sup>

The existence of substantial sea lion populations along the California coast where there is extensive boat traffic supports our opinion that, in general, boat traffic will have little adverse effect on sea lions in the Gulf of Alaska. On the other hand, helicopter or other aircraft

that a high degree of curiosity will exist, following some initial avoidance of areas of human activity or machinery noise. We expect that these animals will find the water column beneath platforms excellent fishing grounds.

#### Influences on Birds

Twelve areas with major concentrations occur on the mainland or on offshore islands adjacent to the broad area offered for this OCS lease-sale.<sup>(5,8)</sup> In general, seabird populations will remain largely uninfluenced by offshore structures and operations. Canadian studies indicate minimal disturbance of several species of birds by helicopters; however, aircraft activity can be programmed to avoid nesting and colonial roosting in day-to-day traffic. It is not anticipated that boat activity accompanying OCS activities will pose any stress on seabird colonies.

Any production, storage or processing facilities constructed onshore should involve consideration of bird breeding and roosting and foraging sites in order to reduce the disturbance of such areas to a minimum. In some instances the conflicts may be obvious, such as a construction site in the immediate vicinity of a large breeding colony or eel grass bed, or less obvious, such as the filling of intertidal mud flats which may serve as a foraging areas for shorebirds.

Those species which tend to be most vulnerable to human disturbances are the colonial nesting species which nest in exposed sites. Adults frightened off nests leave their young vulnerable to exposure and predation. Knowledge of the sensitivity of these birds to such factors will lead to operational plans designed to limit or avoid any adverse effects on their populations.

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STATEMENT OF

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STANDING COMMITTEE  
GULF OF ALASKA OPERATORS' COMMITTEE

before the

U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

HEARING

on

PROPOSED OIL AND GAS LEASING

on the

OUTER CONTINENTAL SHELF  
NORTHERN GULF OF ALASKA

ANCHORAGE, ALASKA  
AUGUST 12-13, 1975

GULF OF ALASKA OPERATORS COMMITTEE

Statement of Clayton D. McAuliffe,  
Chevron Oil Field Research Company

OFFSHORE SALE ENVIRONMENTAL HEARING

Anchorage, Alaska

I am Clayton McAuliffe, Senior Research Associate, with Chevron Oil Field Research Company, La Habra, California. I received my doctorate in Soil Science with minors in Physical Chemistry and Plant Physiology from Cornell University, and was a professor at Cornell University and North Carolina State University for 8 years before joining Chevron Oil Field Research Company 19 years ago.

I am a member of the American Chemical Society, The Soil Science Society of America, the American Society of Agronomy, a member and Fellow of the American Association for the Advancement of Science, the Society of Petroleum Engineers and several honorary societies. I have published over 40 papers covering a variety of subjects in scientific journals and I have a number of U. S. and foreign patents.

For over five years I have devoted my time almost exclusively to a study of petroleum in the marine environment. I assisted in the planning and coordinated the extensive chemical and biological studies conducted during and following the 1970 Chevron oil spill in the Gulf of Mexico. I performed a similar function following the collision of the tankers in San Francisco Bay in 1971. I served on the Steering Committee of the National Academy of

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Sciences Panel on Inputs, Fates, and Effects of Petroleum in the Marine Environment which resulted in the recent NAS publication "Petroleum in the Marine Environment". For the past four years I have been associated with the American Petroleum Institute's Committee on Fate and Effects of Oil in the Environment. I have also served on various other environmental and science advisory committees.

#### INTRODUCTION

Today I will review what happened to crude oil during a major oil spill as revealed by studies during and following the Chevron Gulf Coast spill and relate these results to the northern Gulf of Alaska to predict what would happen to the oil in the unlikely event that a major spill should occur. Before undertaking this I'd like to review some general observations concerning offshore crude oil spills.

As shown in Slide 1, the probability of a major oil spill is low. There have been only three major spills from offshore production platforms in the drilling of approximately 19,000 wells in the U.S. offshore.

Based upon the amount of oil discharged during these three major spills, it is predicted that if a major spill occurs in the Gulf of Alaska, it probably will range from 20,000 to 100,000 barrels.

Based upon past experience, a major oil discharge from an offshore platform may last for several weeks and possibly for a month or two.

During the period of oil discharge, it is obvious that the highest concentrations of oil will always be at the point of discharge.

To date the amount of oil discharged to the marine environment from offshore spills has been less than 2% that of the total petroleum input (National Academy of Sciences, 1975). As offshore production increases, the amount of oil discharged may increase, but probably will remain a small fraction compared with total input to the oceans. It may even become less because of improved drilling practices, and the employment of fail-safe valves in the oil wells.

As will be discussed in other testimony, the only documented adverse effects from major crude oil spills have been to some species of intertidal organisms when oil stranded on the shore (Straughan, 1971), and to sea birds if they were present. Therefore, efforts should be made to reduce the stranding of oil to an absolute minimum. I will later in my testimony make comments concerning a method for minimizing possible impacts of oil.

Some publications which have treated the issue of movement of oil spills have not given adequate recognition to the numerous changes which oil undergoes when discharged to the marine environment. Indeed, some studies on the subject have as a major assumption, the proposition that once oil is spilled, it will continue to drift around the ocean essentially unchanged for 50 or even 100 days. This assumption is clearly a false one, and it leads to unrealistic oil spill trajectories and hypothesized adverse impacts of the oil.

I wish to devote the major portion of my testimony to the numerous changes oil undergoes before discussing possible oil spills and oil spill trajectories in the proposed lease areas of the northern Gulf of Alaska.

Although laboratory studies, visual observation of small oil spills at sea, and oil spill models provide some information, the extrapolation of the results of these studies to a major spill situation is largely speculation. I believe that the best prediction of what might happen in the event of a major spill in the Gulf of Alaska is to extrapolate observed results from a major crude oil spill (McAuliffe et al, 1975) with proper modifications for the different environment in the northern Gulf of Alaska.

When oil is discharged to the marine environment, it undergoes a number of rapid physical changes including spreading, dispersion, evaporation, solution, sedimentation, and emulsification. Beginning immediately, but proceeding at slower rates, are other crude oil alterations including biodegradation, photo-oxidation, and incorporation by marine organisms other than bacteria.

Of the three major offshore platform spills, chemical and biological studies were conducted only for the Santa Barbara and Chevron Gulf of Mexico spills. The Chevron study was one of the most comprehensive and diagnostic investigations ever made of an offshore crude oil spill. We believe that reference to this investigation and to the summary paper published in the Proceedings of the 1975 Conference on Prevention and Control of Oil Pollution held in San Francisco in March would be useful to the BLM in connection with the preparation of the final environmental impact statement.

#### MAIN PASS BLOCK 41 OIL SPILL

Chevron production platform C, Main Pass Block 41 Oil Field, located 11 miles east of the Mississippi River Delta in 40 ft of water, caught fire February 10, 1970. On March 10 the fire was successfully extinguished and oil was discharged until March 31 when the last wells were brought under control. During this three-week period, an estimated 35,000 to 65,000 bbls of crude oil was discharged. Assuming the higher value, the initial rate of discharge was approximately 6,000 B/D, decreasing to 1,500 B/D during the final week. As a safety precaution during the fire and oil spill, 2,006 bbls of chemical dispersants were mixed in water and sprayed on the platform and surrounding water surface. The addition of chemical dispersants (surfactants) breaks the oil into small droplets which do not stick to each other, but mix into water. An everyday example of an emulsion is cream. It is an emulsion of butterfat in water and it disperses when added to coffee.

Slide 2 shows the Mississippi River Delta region and the location of the Main Pass Block 41 C Platform. Shown on the slide is a composite of the surface oil slick during the three-week period of oil discharge. On most days the slick was about six to nine miles in length and 1.0 to 1.5 miles wide. On two days, with relatively calm weather, the surface slick was observed 40 miles to the south and on another day it extended a similar distance to the east.

Appreciable amounts of oil were emulsified by the dispersants. This emulsified plume extended no more than 1.0 to 1.5 miles from the platform which would be within the small circle drawn around the platform on the map.

During the last five days of the spill, water samples were collected in the immediate vicinity of the platform and outward at distances up to 30 miles. Water samples were collected from near-surface, mid-depth, and near-bottom. On three days, water samples were collected in the emulsified oil plume in areas which visually had the highest concentrations of oil-in-water emulsion in the near-surface waters.

Following the spill a large number of bottom sediment samples were collected for hydrocarbon and benthic organism analysis throughout the study area extending north as far as northern Chandeleur Sound and south around the Mississippi River Delta.

For a year following the spill, a large number of trawls collected fish, shrimp, and crabs. The trawls were made principally between the platform and the delta in order to intercept shrimp that would have migrated through the oil spill area.

Water, sediment, benthic, and trawl samples were appropriately analyzed and the next slides show what happened to the oil. Based upon the crude oil composition and verified by gas chromatographic analysis of oil samples collected from the water surface (Slide 3), between 25 and 30% of the oil evaporated into the atmosphere during the first 24 hours. Between 10 and 20% of the oil was

skimmed from the water surface even though the recovery devices were far less efficient than those which are available now, more than 5 years later.

Hydrocarbons dissolved in the water column were found only in the platform vicinity in the emulsified oil plume. All other waters contained dissolved hydrocarbons in concentrations of less than one part per billion (ppb). The dissolved hydrocarbons were low-molecular weight (less than 10 carbon atoms in the molecule) with about one-half the dissolved constituents being low-molecular weight aromatic hydrocarbons--benzene, toluene, xylenes, and trimethylbenzenes. These low-molecular weight aromatic hydrocarbons are considered to be toxic to biological life. Note, (Slide 3) that the dissolved hydrocarbon concentrations at the platform ranged from .02 to 0.2 ppm decreasing to 0.002 ppm (2 ppb) at approximately one mile. On one day, dissolved hydrocarbons were observed in mid-depth and near-bottom waters near the platform in the 2 to 5 ppb range. From the dimensions of the emulsified oil plume, the dissolved hydrocarbon concentrations in the water, the rate of oil discharge, and water current, it was possible to calculate the amount of oil that dissolved in water. The amount dissolved averaged 0.15% during the first two hours. Because the emulsion droplets were small, the rate of solution would have been rapid initially and then decreased with time. Therefore, it is estimated that less than 1% of the oil dissolved the first day.

Slide 4 summarizes what happened to portions of the oil. The concentrations of oil in the emulsion plume ranged from 2 to 60 ppm at the platform and decreased to 1 ppm at one mile. The oil was not found in mid-depth (20 ft) samples under the emulsion plume, showing that emulsified oil was only in the near-surface waters. Again, knowing the dimensions of the emulsion plume, concentrations, and flow rates, it was possible to calculate that from 10 to 50% of the oil was emulsified.

Analysis of numerous sediment samples by gas chromatography documented that crude oil settled to the bottom only within a five-mile radius of the platform. The concentrations for the  $C_{12}$ - $C_{33}$  hydrocarbon fraction measured by gas chromatography and for total oil are shown ranging from 125 to 625 mg/l for the highest values with mean values of 31 and 151 mg/l of sediment.

To obtain an adequate amount of sediment for oil analysis, the top 1.5 inch interval of 2.0 inch diameter cores was extracted. The next lower 1.5 inch core interval analyzed did not contain Main Pass Block 41 crude oil, thereby showing that the sedimented oil was found only in upper 1.5 inches of sediment.

The remaining oil, not accounted for, is thought to have dispersed throughout the water column and possibly sedimented. It was diluted to such low concentrations as to be immeasurable.

In addition to these weathering processes, biodegradation was occurring.

Slide 5 compares the gas chromatogram for oil collected from the water's surface about 0.5 mile from the platform with chromatograms of oil in sediment samples located near the platform. The top

chromatogram of the partially weathered oil (loss of hydrocarbons below normal  $C_{13}$ ) has marked normal alkane peaks sticking up like fingers and numbered from 13 through 35. Hydrocarbon oxidizing bacteria, found in all marine waters, apparently started to biodegrade the oil immediately as shown in the bottom 2 chromatograms. The normal alkane peaks are much reduced in the oil extracted from a sediment sample collected 2 miles south of the platform one week after the spill, and they are essentially gone from the oil in the sediment sample taken one month after the spill 3 miles south of the platform. The small normal alkane peaks visible in the bottom chromatogram in the  $C_{27}$ - $C_{35}$  region are of biogenic origin.

Additional evidence of weathering is shown in Slide 6. Oil from Main Pass Block 41 identified by gas chromatography was measured at three locations after the spill and ranged from 50 to 125 ppm. Samples collected at these same locations (within 10 to 15 ft by accurate Raydist navigation) 11 months later had oil contents from 3 to 6 mg/l (ppm). These concentrations are approximately equal to background values for sediments from this part of the Mississippi Delta.

Although my testimony is principally to document what happened to the oil discharged during the Chevron spill, I do wish to make a few comments about the observed effects of the oil discharge on marine life.

We have just shown that the concentrations of dissolved hydrocarbons and oil emulsified in the water column were relatively low and diluted very rapidly. With a current of 0.5 knot, the

concentrations became less than 1 ppb at the end of a two-hour period one mile from the platform. Thus, even planktonic organisms moving with the water containing emulsified oil were subjected to low hydrocarbon concentrations for a very short period of time - short compared with bioassay tests which are normally conducted for 4 days. Bioassay data cited by the draft EIS and in Marine Bioassays Workshop Proceedings, 1974, show that much higher concentrations of oil and dispersed oil are required to cause half-kill of test organisms, including eggs, larvae, and juvenile stages.

Bioassay tests using six different species of organisms were conducted with Main Pass Block 41 crude oil and the two dispersants used during the oil discharge period. The concentrations of oil and emulsified oil required to cause one half-kill were much higher than the concentrations measured in the sea water at the time of the spill, and the exposure time was 4 days. These data would predict no measurable effect from the oil and emulsified oil on marine life. This conclusion was confirmed because no dead or distressed organisms were observed during the spill. Divers were under the platform on several occasions and observed fish, shrimp, and other marine life with no evidence of distress.

Planktonic organisms were exposed to low concentrations of oil for a short period of time and mobile organisms can leave the area, but benthic organisms living on and in the bottom sediments are sedentary. They were subjected to possible effects from the oil for the entire discharge period. Over 550 species of benthic organisms were identified in 233 benthic samples throughout the

study area. Within seasonal variations, bottom sediment type, and possibly other environmental parameters, it was not possible to measure an effect of the spilled oil on these benthic organisms. There was no correlation of number of species or number of individuals or other biological parameters with the hydrocarbon contents of sediment samples within a 10-mile radius of the platform. It is within this area that an effect, if one were to occur, would be expected from sedimented oil. This lack of correlation strongly suggests a lack of significant effect of oil on the benthic organisms.

The extensive trawl samples showed no alteration in the annual life cycle of commercially important shrimp. Blue crabs were observed throughout the study area, and the number of species of fish collected in the trawl samples in the study area were comparable to a previous survey conducted by the Louisiana Estuarine Inventory conducted along the entire coast of Louisiana.

I have attached a reprint of the paper summarizing the Chevron Chemical and Biological investigations to my testimony.

#### EXTRAPOLATION OF CHEVRON GULF SPILL RESULTS TO NORTHERN GULF OF ALASKA

Statements have been made that it is not possible to extrapolate the results of a study from one area to another. To a certain extent this is true, but good estimates can be made from such an extrapolation. Such an evaluation is much better than merely stating that we don't know what to expect in a new exploration area such as the northern Gulf of Alaska.

#### Life of a Surface Slick

During the Main Pass Block 41 spill, oil on the water's surface which left the platform in one direction on a given day, followed by a change in the wind which carried the oil in a different direction the next day, revealed that first day's slick could not be found on the second day. Details of individual slicks are given by Murray et al, 1970, and Murray, 1975. The fact that the slick extended on most days a maximum of six to nine miles from the platform with a 0.5 knot current indicates a maximum life of oil on the surface of 12 to 18 hours.

The discharge of this same crude oil to the waters of the northern Gulf of Alaska would probably show a somewhat longer life, but not to an appreciable extent. The University of Alaska study (Kinney et al, 1969) in the Cook Inlet indicated the half-life of a crude oil spill was less than one day with complete disappearance after four to five days. A similar observation was made, even in the winter time, for the spill that occurred at the Drift River terminal. The oil moved throughout portions of the Cook Inlet quickly, but was not observed to persist.

The Main Pass Block 41 crude oil was 34° API gravity. Cook Inlet crude oils have API gravities ranging from 35° to 45° and crude oils from the Katella oil field measure 41-45° API. If similar oils are discovered in the northern Gulf of Alaska, the rates of weathering and dispersion should be at least as rapid as

observed in the Cook Inlet. Because of higher winds and waves, the weathering and dispersion may be more rapid.

#### Evaporation

The rate of oil evaporation would be somewhat slower in the northern Gulf of Alaska as compared with warmer waters due to the lower vapor pressure of the hydrocarbons. If the temperature was 10°C lower, the rate of evaporation would be approximately one-half. The average water temperature during the Chevron spill was 15°C. The northern Gulf of Alaska water temperatures range from 4 to 14°C while nearshore waters range from 9 to 12°C. The maximum water temperature difference comparing the Chevron spill with the coldest northern Gulf of Alaska water would be about 10°C and sometimes less. Therefore, the maximum decrease in evaporation rate would be approximately one-half that observed for the Gulf of Mexico spill. However, the higher average wind velocities would increase the rate of evaporation in the Gulf of Alaska as compared with the Gulf of Mexico. The rate of evaporation increases linearly with wind speed. Higher winds would partially compensate for lower water temperatures and if wind velocity was twice that in the Gulf of Mexico, wind would completely compensate for water temperatures 10°C lower.

#### Dissolved Hydrocarbons

The rate of solution of hydrocarbons from a similar oil into the Alaskan Gulf water column would be somewhat slower than in the Gulf of Mexico because a similar oil would have a lower

viscosity due to lower water temperatures. The transfer of the hydrocarbons to water would be at a lower rate. In both the Gulf Coast and the Gulf of Alaska, hydrocarbons that do dissolve will either biodegrade or evaporate back into the atmosphere. Low molecular weight aromatic hydrocarbons have the highest hydrocarbon solubilities in water, but are still relatively insoluble. Because there is no reservoir of these hydrocarbons in the atmosphere, they evaporate from the water column into the atmosphere (McAuliffe, 1974). The rate of evaporation of soluble hydrocarbons from oil greatly exceeds the rate of their solution into water (McAuliffe et al, 1975; Harrison et al, 1975).

#### Biodegradation

Biodegradation rates in cold waters are slower than in warmer waters. However, we believe that the rate of biodegradation set forth in the draft Environmental Impact Statement is understated, because it is based upon the reduction in rate which occurs in chemical reactions (i.e., rate reduced one-half for each 10°C lowering of temperature). In preparing the final EIS, the BLM may wish to consider the following material. Slide 7 shows studies which have been conducted using Prudhoe Bay crude oil in Prudhoe Bay waters. Atlas (1973) found that in three days the percentage degradation at 5°C was 21% whereas at 25°C it was 39%. Atlas tested a 20°C temperature difference, but the rate of biodegradation at 5°C was less than one-half the rate at 25°C. In five weeks, 60% of the oil was lost and when Atlas added

nitrogen and phosphorous as nutrients to the water, 80% of the oil biodegraded in five weeks. ZoBell (1973) using Prudhoe Bay crude oil found 61% biodegradation in ten weeks even with the water at  $-1.1^{\circ}\text{C}$  (below freezing).

The information just discussed suggests that the half-life of a crude oil spill in the Gulf of Alaska would be of the order of one day and with complete loss of oil from the surface by five days. Thus, any appreciable stranding of oil would not occur in a period exceeding three days, and the slick life might be less.

The draft Environmental Statement discusses oil spill trajectories in the northern Gulf of Alaska and recognizes in its initial statement dispersion, weathering, and biodegradation processes. However, it then discusses proposed trajectories and continues to give probabilities of stranding for long periods of time, up to 88 days for average times and no limit for maximum times. Slide 8 shows the approximate location of the Sites 3 and 4 estimated from figures in the CEQ report and the draft EIS. Site 3 is about 20 miles from shore. Site 4 is 60 miles from Montague Island and a similar distance from the Copper River Delta. At the bottom of the figure are listed the minimum and average times in days for oil to strand from these sites as calculated in the CEQ report. Only in the winter and fall at Site 3 is there an indication of oil stranding after a minimum three day period; the average times are very much longer.

Based upon the weathering and dispersion of the oil which we have previously discussed, there is little likelihood of significant quantities of oil from even a major spill stranding on the coastline

from these representative sites in the two major proposed lease areas.

Also shown on Slide 8 is a possible location for a "worst case" situation postulated in the draft EIS - a 100,000 bbl spill over 61 days 4 miles from shore with the oil driven continually ashore by wind. Until oil in commercial quantities has been discovered, possible spill locations and oil spill trajectories are only conjecture.

The use of meteorological and oceanographic data is helpful in predicting oil spill trajectories. The Gulf of Alaska Operator's Committee is calculating spill trajectories from a number of sites throughout the lease area based upon past meteorological information. The Operator's Committee also is currently obtaining additional meteorological and oceanographic information from which spill trajectory calculations can be made. These data will be incorporated into oil spill contingency plans.

There are certain areas which are more subject to impact than others. For example, oil discharged within three or four miles of shore is likely to strand. Water currents (geostrophic) are consistently to the west, and winds are predominately from the east and southeast. The probability of oil coming ashore east of a possible spill location is very remote. In the eastern portion of the lease area a spill close to shore or to Kayak Island would likely strand.

The western lease area, however, is sufficiently far from shore that it is unlikely appreciable quantities of oil would strand. If oil did strand, it would probably do so on Montague Island or on Middleton Island.

#### RISK ANALYSIS

The draft EIS undertakes a "Proximity Evaluation and Summary Risk Analysis" which recognizes the dispersion and weathering of spilled oil, but does not compensate for them. The analysis uses the shortest distance to shore or environmentally sensitive areas from each lease tract, and the movement of oil at a constant speed of 0.4 mile per hour. The analysis also does not consider current and wind directions or velocities. The evaluation concludes that 100 blocks have a high potential risk for three types of impacts, 168 for two impacts, 56 for one impact, and that only six blocks would not have an environmental impact. These six tracts are located closest to the Copper River Delta.

In preparing the final EIS, the BLM should consider the weathering and dispersion of oil that we have discussed in this statement and referenced in the scientific literature, and to use spill trajectories suggested by meteorological and oceanographic data to obtain a more meaningful analysis of possible adverse environmental impacts from a possible oil spill from each lease tract. The BLM might also consider the use of dispersants to minimize possible adverse effects in their risk analysis.

#### ADVANTAGES OF USING DISPERSANTS

Major crude oil spills have had documented adverse environmental effects only if oil stranded in the intertidal zone, or to birds if they were present at the time of the spill. Thus, methods of

minimizing oil adherence to feathers or preventing the stranding of oil ashore would be beneficial. Emulsification of the oil is such a method. I have already discussed the use of dispersants during the Chevron Gulf Coast spill and the demonstrated lack of adverse effects on the marine environment.

The use of oil dispersants received adverse publicity at the time of the Torrey Canyon spill. However, the dispersants and their formulation in toxic solvents as well as improper use in the intertidal zone, resulted in the adverse environmental effects; the intertidal zones have subsequently recovered. This adverse publicity resulted in the U.S. Environmental Protection Agency banning the use of dispersants in this country other than for safety reasons. Other countries and scientists in other countries recognized the advantageous use of surfactants, and dispersants are used to disperse oil (Marine Pollution Bulletin, 1975; Canevari, 1969, 1971, 1973, 1975; McAuliffe et al, 1975).

Slide 9 documents some of the advantages of using dispersants. First and foremost is the rapid dilution which occurs with emulsification. The dispersed oil mixes downward in near surface water and removes oil from the water's surface. The bulk of the oil is removed from most of the wind's influence and the oil does not travel as far as a surface slick (Chevron spill, 1 mile vs 6-9 miles average distances). The life of the surface oil slick would be reduced and significant amounts of oil are not likely to reach shore or move to biologically sensitive areas after one day.

Emulsification greatly lessens the tendency of oil to stick to itself and to solid surfaces. It, therefore, would lessen bird kill, although not eliminate it because not all oil can be emulsified and some remains on the surface. It would reduce the tendency of oil to adhere to solid particles (silt) in the water and therefore lessen the amount of oil that would sediment (Canevari, 1971; McAuliffe, 1973). It would particularly lessen the sedimentation of oil if the situation existed where surface oil met turbid water from the mouth of a river for example. Without emulsification, the oil might sink and be concentrated in the sediments at the zone where the oil met the turbid water.

If emulsified oil should strand in the intertidal zone, it would have very much less tendency to adhere to sand, rocks, or other solid surfaces. Emulsified oil would be in low concentrations and eliminate smothering of marine life in the intertidal zone which may occur with non-dispersed crude oil which has lost light components at sea. The emulsion would have a tendency to wash back out with receding tide and subsequent tides.

Emulsification would accelerate biodegradation by presenting a larger surface area to volume of oil. It likewise would accelerate physical weathering such as evaporation and solution with those soluble constituents dissolved in the water column subsequently either biodegrading or evaporating into the atmosphere.

Emulsification might also increase oil oxidation by exposing more of the oil's surface to the sun relative to the volume of oil even though the oil is removed from the immediate water surface. Emulsified oil stays principally in near-surface waters as documented during the Chevron oil spill.

SUMMARY

In summary, we believe that the probability of a major oil spill in the proposed lease area is very low, and that the odds may be more favorable than past experience, because of improved drilling practices and fail-safe well control valves.

We have documented what happened to oil discharged during the Chevron Gulf of Mexico spill, and showed that there was no measureable effect on marine life.

We believe that results from the Gulf Coast spill can be used to predict what would happen to oil from a possible spill in the northern Gulf of Alaska.

We believe that dispersing spilled oil has many advantages.

We believe that considering changes that occur when oil is discharged to the water surface, the use of meteorological and oceanographic data is a general way to predict spill trajectories, and the use of dispersants, will greatly reduce the number of tracts from which a spill is predicted to have observed environmental impacts as summarized in the draft EIS.

It is our belief that exploration, production, and transportation of crude oil, if found, can be conducted in the northern Gulf of Alaska without significant adverse environmental impacts.

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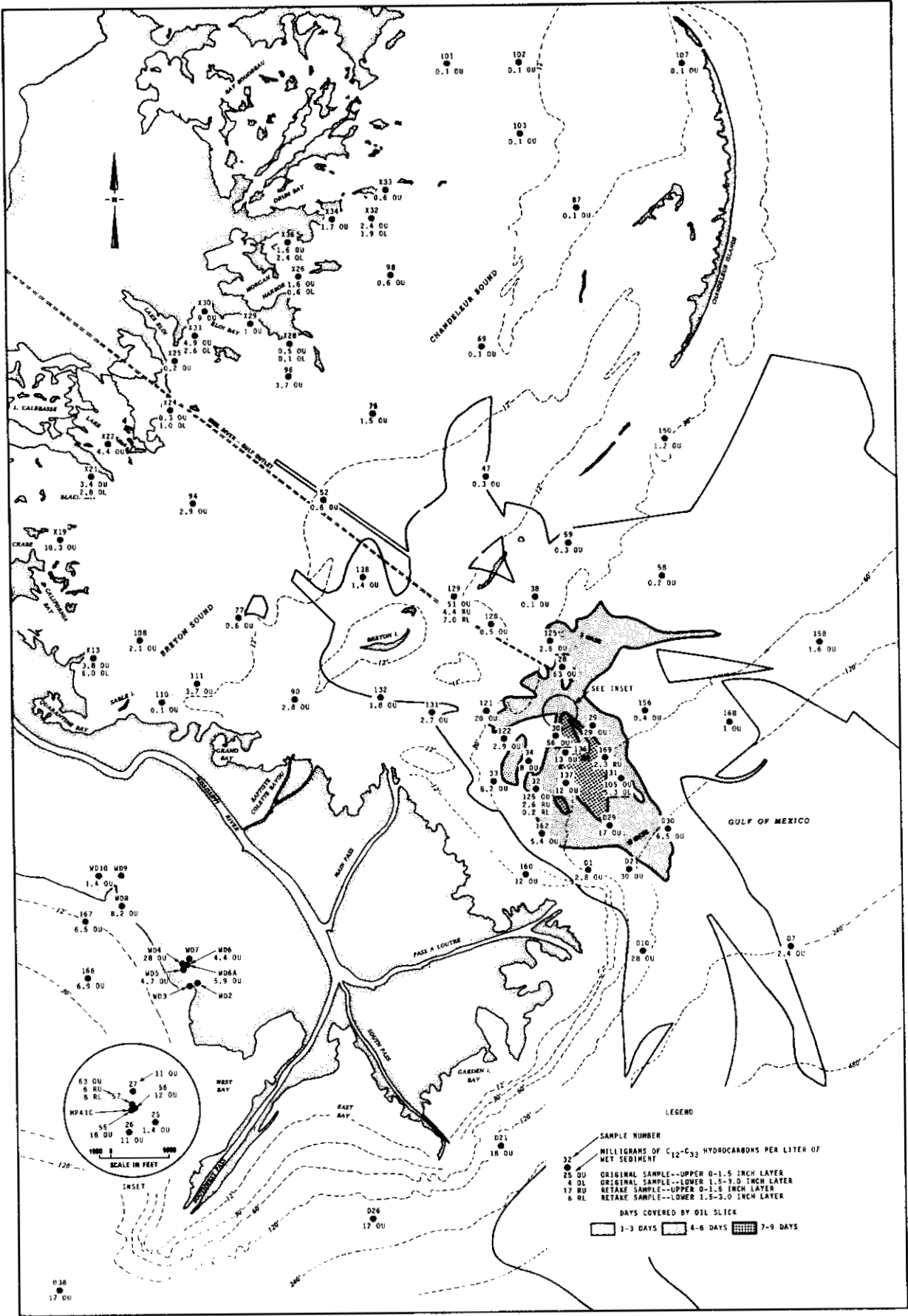
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SLIDE 1

## **SOME GENERAL OBSERVATIONS CONCERNING OFFSHORE CRUDE OIL SPILLS**

- THE PROBABILITY OF A MAJOR OIL SPILL IS LOW—ONLY 3 MAJOR SPILLS IN U.S. OFFSHORE WATERS.
- THE AMOUNT OF OIL LIKELY TO BE SPILLED — 20,000 TO 100,000 BARRELS.
- LENGTH OF SPILL — SEVERAL WEEKS TO SEVERAL MONTHS.
- HIGHEST CONCENTRATION OF CRUDE OIL WILL BE AT POINT OF SPILL.
- AMOUNT OF OIL FROM MAJOR OFFSHORE PLATFORM SPILLS HAS BEEN LESS THAN 2% OF TOTAL PETROLEUM INPUT.
- STUDIES OF MAJOR CRUDE OIL SPILLS HAVE DOCUMENTED ADVERSE EFFECTS ONLY ON SOME SPECIES OF INTERTIDAL ORGANISMS, AND TO BIRDS.
- OIL DISCHARGED TO THE MARINE ENVIRONMENT UNDERGOES A NUMBER OF PHYSICAL, CHEMICAL, AND BIOLOGICAL CHANGES.

SLIDE 2



SLIDE 3

## **FATE OF DISCHARGED OIL**

EVAPORATED 25-30% DURING FIRST 24 HOURS

RECOVERED 10-20% SKIMMED FROM WATER SURFACE

DISSOLVED IN WATER 0.15% IN 2 HOURS, ESTIMATED LESS THAN  
1% IN 24 HOURS.

HIGHEST CONCENTRATION AT PLATFORM RANGED FROM 0.02 TO 0.2  
ppm, DECREASING TO 0.002 ppm AT APPROXIMATELY 1 MILE.

SLIDE 4  
**FATE OF DISCHARGED OIL**

EMULSIFIED IN WATER (OIL-IN-WATER EMULSION) 10-50%

HIGHEST CONCENTRATION OBSERVED ON 3 DAYS AT PLATFORM  
RANGED FROM 2 TO 60 ppm DECREASING TO 1 ppm AT 1 MILE.

SEDIMENTED LESS THAN 1% WAS FOUND IN BOTTOM SEDIMENTS WITHIN  
A 5 MILE RADIUS OF THE PLATFORM.

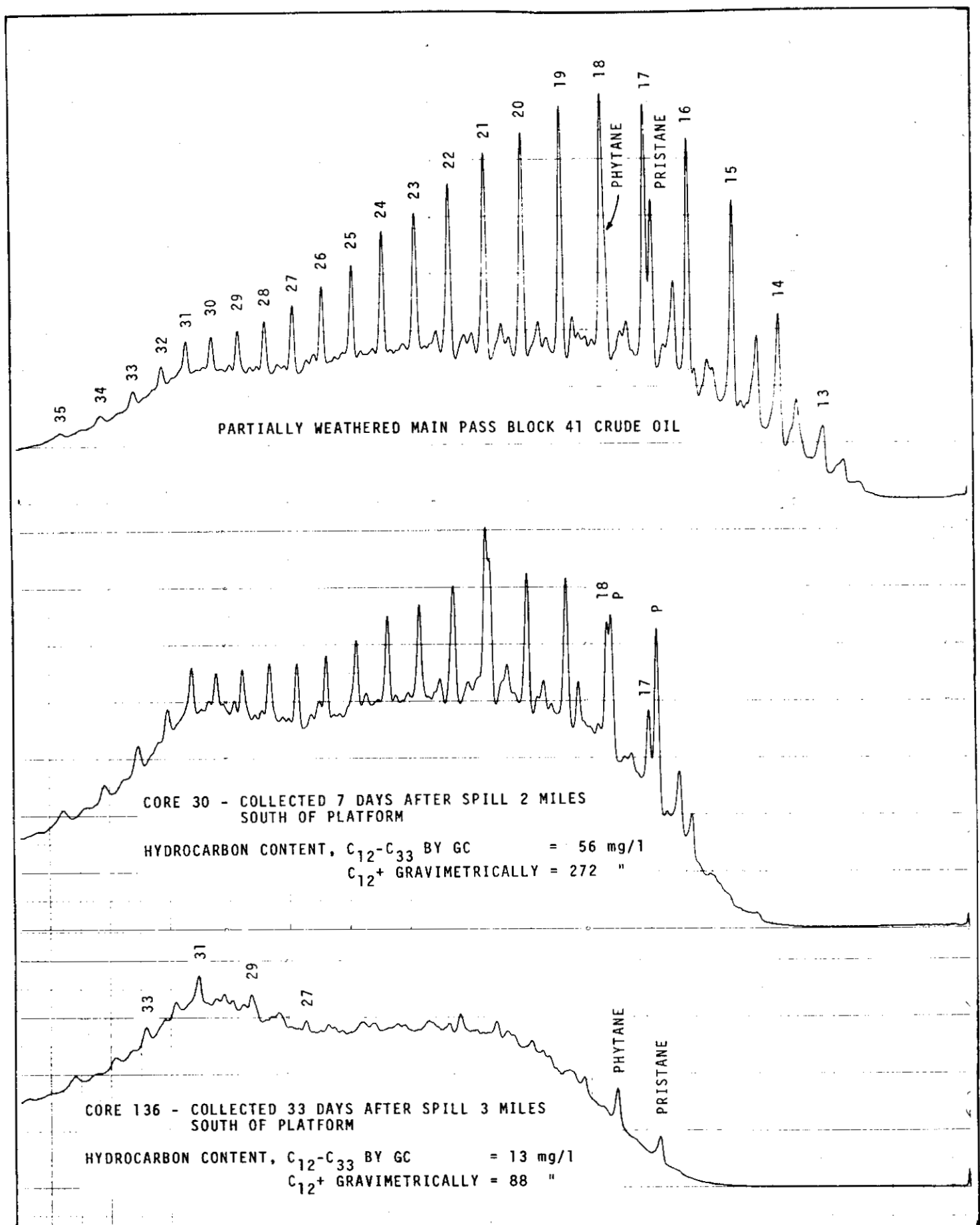
CONCENTRATIONS:

C<sub>12</sub>-C<sub>33</sub> FRACTION - HIGHEST, 125 mg/l; MEAN 31 mg/l

C<sub>12</sub> PLUS FRACTION - HIGHEST, 624 mg/l; MEAN 151 mg/l

DISCHARGED OIL IN SEDIMENTS WAS RESTRICTED TO UPPER 1.5 INCHES

SLIDE 5



SLIDE 6

## ADDITIONAL EVIDENCE OF WEATHERING

C<sub>12</sub>-C<sub>33</sub> HYDROCARBON FRACTION IN SEDIMENTS (CONCENTRATIONS IN mg/l)

AFTER SPILL

125  
63  
51

11 MONTHS LATER

2.5  
6  
4

APPROXIMATELY  
BACKGROUND VALUES

SLIDE 7

## **CRUDE OIL BIOGRADATION**

CRUDE OIL BIODEGRADATION RATES ARE APPRECIABLE AT ARCTIC TEMPERATURES, BUT NOT AS RAPID AS IN WARM WATERS.

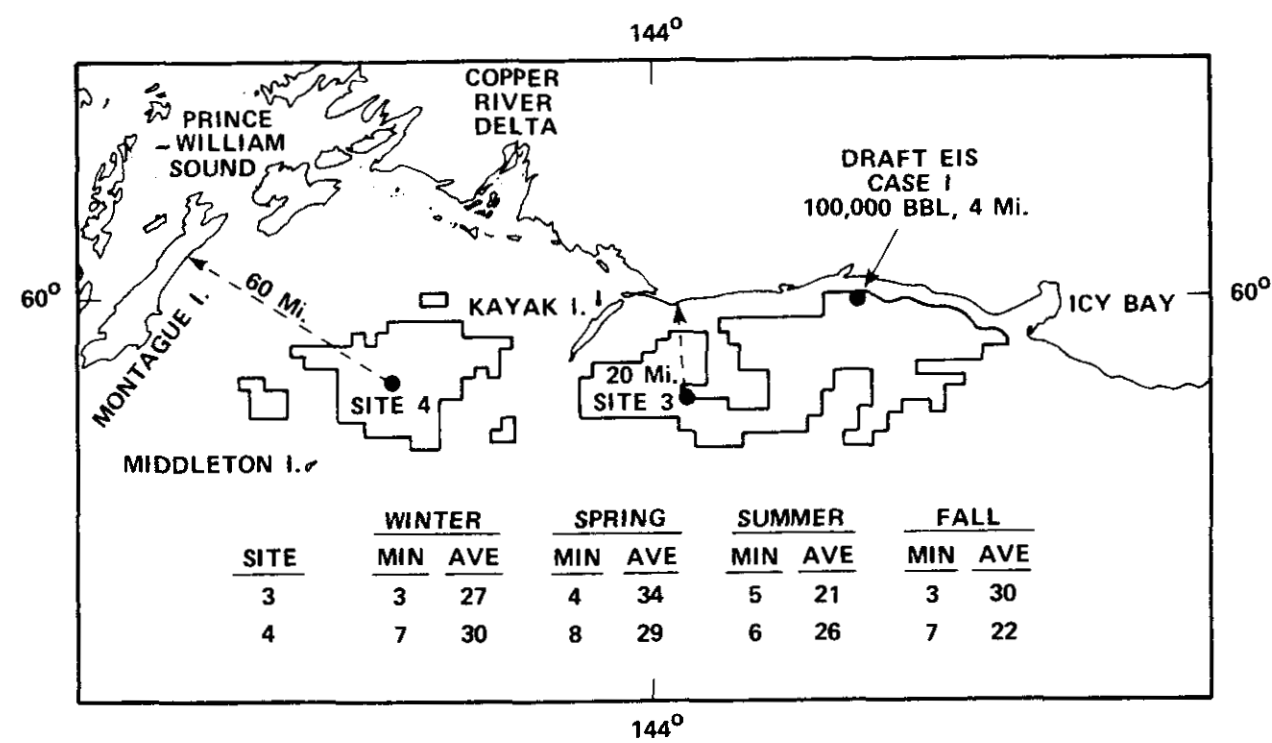
ATLAS FOUND THE FOLLOWING BIODEGRADATION RATES IN 3 DAYS FOR PRUDHOE BAY CRUDE OIL IN PRUDHOE BAY WATER.

5°C	21%
25°C	39%

IN 5 WEEKS 60% OF THE OIL WAS LOST. WITH NITROGEN AND PHOSPHORUS ADDED TO THE WATER, 80%.

ZOBELL FOUND 61% BIODEGRADATION IN 10 WEEKS AT  $-1.1^{\circ}\text{C}$ .

SLIDE 8



SLIDE 9

## **ADVANTAGES OF USING DISPERSANTS (SURFACTANTS)**

- RAPID DILUTION
- GREATLY REDUCES TENDENCY OF OIL TO "STICK" TO SOLID SURFACES
  - REDUCE BIRD KILL
  - REDUCE SEDIMENTATION
  - REDUCE AMOUNT OF OIL IN INTERTIDAL ZONE
- ACCELERATE BIODEGRADATION
- ACCELERATE PHOTO-OXIDATION
- ACCELERATE PHYSICAL WEATHERING
  - EVAPORATION
  - SOLUTION AND SUBSEQUENT EVAPORATION

#### BIOGRAPHICAL SKETCH

Clayton McAuliffe was born August 18, 1918, in Chappell, Nebraska. He received an A.B. degree in chemistry with high distinction from Nebraska Wesleyan University in 1941. He was a Frasch Foundation Fellow at the University of Minnesota where he obtained his M.S. degree in 1942. He was a Research Fellow at Cornell University, 1942-43 and 1946-48, and obtained his Ph.D. degree in soil science in 1948.

He was a Laboratory Assistant in inorganic chemistry 1939-40 and organic chemistry 1940-41 at Nebraska Wesleyan University. He was on the Manhattan Project as a Research Chemist with the Division of War Research, Columbia University, 1943-44, and with Union Carbide at Columbia and Oak Ridge, Tennessee, 1944-46. He was a consultant with the U. S. Department of Agriculture 1947-48, Research Associate at Cornell University 1948-50, and Research Associate Professor at North Carolina State University 1950-56. Since 1956 he has been with Chevron Oil Field Research Company, La Habra, California, where he is Senior Research Associate.

He has published 40+ papers in scientific journals on subjects such as petroleum in the marine environment, improving fluid flow through porous media to improve oil recovery, solubility of hydrocarbons in water, geochemistry in petroleum exploration, soil chemistry, radioisotopes and stable isotopes in soil-plant investigations, and stable isotopes in surface area measurements. He holds 20+ United States and foreign patents.

He is a member of the American Chemical Society, Society of Petroleum Engineers of AIME, American Society of Agronomy, Soil Science Society of America, and the American Association for the Advancement of Science. He is a member of Phi Kappa Phi, Sigma Xi, and Alpha Gamma Rho.

He is a Fellow of the American Association for the Advancement of Science and was Visiting Scientist Lecturer for the Soil Science Society of America, 1964-1967.

STATEMENT OF

DR. DALE STRAUGHAN

BEFORE THE

U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

HEARING

ON

PROPOSED OIL AND GAS LEASING

ON THE

OUTER CONTINENTAL SHELF

NORTHERN GULF OF ALASKA

ANCHORAGE, ALASKA  
AUGUST 12-13, 1975

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STATEMENT FOR ENVIRONMENTAL HEARING FOR THE  
PROPOSED GULF OF ALASKA LEASE SALE  
DALE STRAUGHAN

MY NAME IS DALE STRAUGHAN AND I AM PRESENTLY A RESEARCH SCIENTIST AT THE ALLAN HANCOCK FOUNDATION, UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.

I RECEIVED MY PH.D. IN ZOOLOGY AT THE UNIVERSITY OF QUEENSLAND IN 1966. SINCE THAT TIME, I HAVE WORKED AT THE JAMES COOKE UNIVERSITY OF NORTH QUEENSLAND, HAWAII INSTITUTE OF MARINE BIOLOGY, AND COSTA RICA BEFORE BECOMING A VISITING ASSISTANT PROFESSOR IN BIOLOGICAL SCIENCES AND A RESEARCH ASSOCIATE OF THE ALLAN HANCOCK FOUNDATION OF THE UNIVERSITY OF SOUTHERN CALIFORNIA IN 1969.

BETWEEN FEBRUARY 1969 AND FEBRUARY 1971, I WAS THE PROJECT DIRECTOR OF THE ALLAN HANCOCK FOUNDATION STUDY TO DETERMINE THE BIOLOGICAL AND OCEANOGRAPHICAL EFFECTS OF OIL POLLUTION FOLLOWING THE SANTA BARBARA OIL SPILL IN JANUARY 1969. SINCE THAT TIME, I HAVE STUDIED THE EFFECTS OF OIL ON MARINE BIOTA UNDER BOTH FEDERAL (SEA GRANT COLLEGE, ENVIRONMENTAL PROTECTION AGENCY AND NOAA) AND INDUSTRIAL (API, WOGA) AUSPICES. THIS HAS INCLUDED STUDIES OF VARIATION IN TOLERANCE OF FIELD POPULATIONS TO OIL POLLUTION, EFFECTS OF OIL AND DETERGENTS ON SURVIVAL OF SPECIES AND RECOLONIZATION OF INTERTIDAL SUBSTRATES, THE THERMAL EFFECTS OF BLACK CRUDE OILS IN THE UPPER INTERTIDAL ZONE, LONG TERM AND SUBLETHAL EFFECTS OF EXPOSURE TO OIL.

I HAVE ALSO TRAVELLED WIDELY TO OBSERVE THE EFFECTS OF OIL SPILLS--'TORREY CANYON' IN CORNWALL, 'FLORIDA' IN MASSACHUSETTS, 'TAMANO' IN MAINE, 'METULA' IN THE STRAITS OF MAGELLAN--AS WELL AS CALIFORNIA AND THE GULF OF MEXICO.

I AM A MEMBER OF THE NATIONAL ASSEMBLY OF ENGINEERING COMMITTEE ON SAFETY OF OUTER CONTINENTAL SHELF PETROLEUM OPERATIONS. THIS COMMITTEE WAS ESTABLISHED TO REVIEW THE U. S. GEOLOGICAL SURVEY PROGRAMS ON THE OUTER CONTINENTAL SHELF. I AM ALSO A MEMBER OF THE NATIONAL OFFSHORE OPERATORS ADVISORY COMMITTEE TO THE COAST GUARD. I HAVE ALSO SERVED AS AN OBSERVER FOR THE ENGINEERING COMMITTEE ON OCEANIC RESOURCES AT THE RECENT MEETING OF ICG FOR GIPME IN PARIS. I AM ALSO ASSISTING IN THE PREPARATION OF A PAPER FOR THE U. N. GROUP OF EXPERTS ON SCIENTIFIC ASPECTS ON MARINE POLLUTION.

I HAVE BEEN ASKED TO COMMENT TODAY BY THE GULF OF ALASKA OPERATORS COMMITTEE.

SOME HAVE EXPRESSED FEARS THAT THE PROPOSED DEVELOPMENT OF THE PETROLEUM RESOURCES OF THE GULF OF ALASKA WILL RESULT IN ENVIRONMENTAL DISRUPTION. ONE PARTICULAR CONCERN IS THE POSSIBILITY OF A LARGE OIL SPILL SUCH AS THE ONE WHICH OCCURRED IN THE SANTA BARBARA CHANNEL IN 1969 AND A SECOND IS THE FEAR OF "CHRONIC POLLUTION."

CERTAINLY EVERY REASONABLE SAFEGUARD MUST BE EMPLOYED TO PREVENT THE OCCURRENCE OF SUCH SPILLS AND ELIMINATION OF POSSIBLE CHRONIC POLLUTION SOURCES. HOWEVER, THERE CAN BE NO ABSOLUTE GUARANTEE THAT THERE WILL BE NO SPILLAGE OF OIL. THEREFORE, ONE MUST ADDRESS THESE PROBLEMS.

EXPERIENCE IN THE SANTA BARBARA AREA SHOULD PROVIDE SOME INSIGHT INTO THE EFFECTS OF OIL SPILLAGE IN THE GULF OF ALASKA. WHILE THE AREA IS COLDER THAN THE SANTA BARBARA CHANNEL, MANY OF THE SAME SPECIES RANGE THROUGH AND BEYOND BOTH AREAS. HENCE, DATA IS AVAILABLE ON THE SURVIVAL OF MANY OF THE SPECIES FOUND IN THE GULF OF ALASKA ON EXPOSURE TO BOTH LARGE DOSAGES OF OIL IN AN ACUTE POLLUTION SITUATION AND TO A CHRONIC EXPOSURE SITUATION.

FIRST OF ALL, I WOULD LIKE TO COMMENT ON THE RESULTS OF OUR WORK IN THE SANTA BARBARA CHANNEL DURING THE PERIOD AFTER THE 1969 SANTA BARBARA OIL SPILL. OUR INITIAL FINDINGS SHOWED A SIGNIFICANT MORTALITY IN BIRD POPULATIONS AND IN THE UPPER INTERTIDAL BARNACLE, CHITHAMALUS FISSUS. THERE WAS ALSO SOME DIE-OFF IN THE SURF GRASS, PHYLLOSPADIX AND THE ALGAE, HESPEROPHYCUS HARVEYANUS. NO REPORTS DEMONSTRATED DAMAGE TO POPULATIONS OF MARINE VERTEBRATES, FISH, SEALS, OR WHALES. FISH CATCH DATA AND A TRAWLING SURVEY BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME AS WELL AS FISH SPOTTING DATA FROM THE BUREAU OF COMMERCIAL FISHERIES DID NOT INDICATE ANY DECREASE IN FISH POPULATIONS DUE TO THE OIL SPILL. A SURVEY OF GREY WHALE STRANDINGS DURING THE LAST DECADE DID NOT SUGGEST THAT FIVE (5) STRANDINGS IN THE MONTH AFTER THE OIL SPILL WAS INORDINATELY HIGH. THROUGH A PROGRAM OF TAGGING OF OILED (75% OF BODY COVERED BY OIL) AND UNOILED ELEPHANT SEALS, OVER A 13 MONTH PERIOD, B. LeBeouf FOUND NO EVIDENCE OF INCREASED MORTALITY AMONG OILED OVER THE UNOILED ANIMALS. THERE WAS ALSO NO PROOF OF AN INORDINATELY HIGH MORTALITY OF SEA LION PUPS AT SAN MIGUEL DUE TO OIL POLLUTION.

IN FEBRUARY, 1971, THE ALLAN HANCOCK FOUNDATION ISSUED A TWO-VOLUME REPORT ON THIS RESEARCH. I WISH TO POINT OUT THAT WE TRIED TO INCLUDE ALL BIOLOGICAL STUDIES BY OTHER GROUPS AND AGENCIES FOLLOWING THE SPILL IN THIS REPORT. THIS INCLUDED EXTENSIVE SURVEYS BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME, BUREAU OF COMMERCIAL FISHERIES, DR. M. NEUSHAL AT THE UNIVERSITY OF CALIFORNIA AT SANTA BARBARA, AND DR. WHEELER NORTH FROM THE CALIFORNIA INSTITUTE OF TECHNOLOGY AMONG OTHERS. THE REPORTS OF THESE SURVEYS SUBSTANTIATED THE FINDINGS BY THE ALLAN HANCOCK FOUNDATION STUDY. THAT IS, THAT THE BIOLOGICAL DAMAGE WAS MUCH LESS THAN PREDICTED IMMEDIATELY AFTER THE SPILL AND THE AREA WAS RECOVERING.

RECOVERY OF THE AREA STARTED WITHIN SEVEN (7) WEEKS OF THE OIL SPILL. THE BARNACLE, BALANUS GLANDULA, HAD SETTLED ON DRY OIL BY THAT TIME. BETWEEN SIX AND SEVEN MONTHS AFTER THE SPILL, THE CALIFORNIA DEPARTMENT OF FISH AND GAME REPORTED "NEAR NORMAL QUANTITIES" OF HESPEROPHYCUS WHILE PHYLLOSPADIX WAS GROWING AGAIN IN DAMAGED AREAS OF THE CHANNEL (A.H.F. REPORT 1:405). CHTHAMALUS EISSUS WAS RECORDED SETTLING ON OILED SUBSTRATES 10 MONTHS AFTER THE SPILL. IN MORE RECENT EXPERIMENTS THIS SPECIES SETTLED ON SUBSTRATES LESS THAN 10 WEEKS AFTER THEY WERE SOAKED IN OIL. THESE EXPERIMENTS ALSO SHOWED THAT RECOLONIZATION RATES DEPEND ON THE SEASON OF THE YEAR. HENCE, RECOLONIZATION BY THIS SPECIES NEED NOT BE DELAYED AS LONG AS 10 MONTHS. THIS WORK IS REPORTED IN THE PROCEEDINGS OF THE CONFERENCE ON PREVENTION AND CONTROL OF OIL SPILLS SPONSORED BY API, EPA, AND THE COAST GUARD IN JUNE, 1971.

ALTHOUGH COMPARABLE DATA TO THAT OBTAINED BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME IN 1969, IS NOT AVAILABLE ON BIRD POPULATIONS FOR LATER YEARS, THE AUDUBON CHRISTMAS CENSUS FOR THE FOLLOWING YEARS (1969-1973) DID NOT REVEAL A LOSS OF BIRDS CORRELATED WITH THE OIL SPILL. THE DIFFICULTY WITH THESE DATA IS THAT THE LEVEL OF EFFORT IS PROBABLY STILL TOO LOW TO REGISTER CHANGES IN THE SANTA BARBARA AREA BECAUSE THE RESULTS ARE RELATED TO THE NUMBER OF OBSERVERS.

IN SUBSEQUENT ECOLOGICAL SURVEYS OF ROCKY SHORES AND SANDY BEACHES IN 1974, WE WERE UNABLE TO DEMONSTRATE DISRUPTION IN THE DISTRIBUTION AND ABUNDANCE OF INTERTIDAL SPECIES DUE TO THE SANTA BARBARA OIL SPILL. OUR CONCLUSIONS WERE THAT ANY DISRUPTION HAD BEEN OF A TEMPORARY NATURE.

AT THIS POINT, I WOULD LIKE TO TAKE EXCEPTION TO FIGURE 45 IN THE EIS WHICH HAS BEEN QUOTED DIRECTLY FROM THE CEQ REPORT. IN THIS FIGURE, CEQ EXTRAPOLATED FROM MY DATA, THAT IT TOOK 3 YEARS FOR OIL FROM THE SANTA BARBARA SPILL TO BE LOST FROM THE SANDY BEACHES. GOD KNOWS HOW THEY CAME TO THAT CONCLUSION! I CAN ONLY SPECULATE THAT THE CEQ WRITERS BELIEVED THAT BECAUSE I SURVEYED THE SANDY BEACHES 2 AND 3 YEARS AFTER THE OIL SPILL, THAT I HAD EVIDENCE THAT OIL FROM THE SANTA BARBARA OIL SPILL WAS STILL ON THOSE SANDY BEACHES. I HAVE NO EVIDENCE THAT OIL FROM THE SANTA BARBARA OIL SPILL WAS STILL ON A SANDY BEACH TWO OR THREE YEARS AFTER THE OIL SPILL. IN FACT, ALL OIL THAT WAS COLLECTED AND THAT COULD BE TRACED TO AN IDENTIFIABLE SOURCE, WAS DESIGNATED SEEP OIL.

ONE OF THE PROBLEMS OF ASCERTAINING POSSIBLE EFFECTS OF OIL POLLUTION IN A NEW AREA IS THAT OF PREDICTION WHEN SO MANY OF THE VARIABLES ARE UNKNOWN. HERE ONE CAN ASSUME THAT OIL OFFSHORE FROM THE GULF OF ALASKA WOULD POSSIBLY BE SIMILAR TO THAT OBTAINED FROM NATURAL OIL SEEPAGE ALONG THE COAST. THE MAJOR PUBLICIZED SPILLAGES OF OIL IN COLD WATERS TO DATE, HAVE BEEN OF ARABIAN CRUDE OILS (E.G., "TORREY CANYON" AND "METULA"). THESE HAVE FORMED LARGE QUANTITIES OF CHOCOLATE MOUSSE--SOMETHING THAT HAS NOT BEEN OBSERVED IN THE SPILLAGE OF OILS ALONG THE WEST COAST OF NORTH AMERICA. THROUGH THE LARGE INCREASE IN VOLUME (CHOCOLATE MOUSSE MAY BE 1 OIL: 4 WATER), OIL IN THIS FORM MAY PHYSICALLY KILL MORE ANIMALS WITHOUT ANY REAL CHANGE IN CHEMICAL TOXICITY.

SAMPLES OF OIL FROM A FIELD NEAR THE GULF OF ALASKA WERE ANALYZED BY DR. TOM MEYERS. HE REPORTED THAT THIS WAS A FULL RANGE CRUDE CONTAINING VOLATILES AND THAT IT WAS REMARKABLY SIMILAR TO SAMPLES FROM PLATFORM A-21 IN THE SANTA BARBARA CHANNEL. THIS WAS BASED ON GAS CHROMATOGRAPHY IN THE C<sub>10</sub> TO C<sub>35</sub> RANGE.

TWO SERIES OF EXPERIMENTS HAVE BEEN CONDUCTED USING INTERTIDAL SNAILS (LITTORINA SCUTULATA) FROM SEWARD, ALASKA, SOUTHERN CANADA, AND SOUTHERN CALIFORNIA, AND SEVERAL TYPES OF PETROLEUM INCLUDING CRUDE OIL FROM THE GULF OF ALASKA AND SANTA BARBARA CRUDE OIL, TO DETERMINE POSSIBLE TOLERANCE DIFFERENCES IN FIELD POPULATIONS. L. SCUTULATA FROM ALASKA SURVIVED AS WELL, AND AT TIMES BETTER, THAN THOSE FROM THE SANTA BARBARA CHANNEL.

MORTALITIES FROM CRUDE OIL WERE LIMITED TO ANIMALS EXPOSED TO 29°C AND APPEAR TO BE A TEMPERATURE RATHER THAN AN OIL EFFECT. SUBLETHAL EFFECTS, INCLUDING ABILITY OF THE SNAILS TO REMAIN ATTACHED TO THE SUBSTRATE WERE ALSO CONSIDERED. IF THE SPECIES IS NOT ATTACHED TO THE SUBSTRATE, IT WILL BE WASHED AWAY AND ESSENTIALLY LOST FROM THE POPULATION. ATTACHMENT RATES OF ANIMALS FROM ALASKA ARE NOT SIGNIFICANTLY DIFFERENT FROM THOSE OF ANIMALS FROM THE SANTA BARBARA CHANNEL.

THE AVAILABLE DATA SUGGEST THAT THE EXPERIENCE IN THE SANTA BARBARA CHANNEL IS MORE RELEVANT TO THE GULF OF ALASKA. THAT IS, THE ENVIRONMENT WILL BE ABLE TO TOLERATE ISOLATED LARGE SPILLAGES OF OIL. HOWEVER, THE WORD ISOLATED MUST BE EMPHASIZED.

LET ME NOW ADDRESS THE SUBJECT OF "CHRONIC" POLLUTION BY PROVIDING SOME INFORMATION FROM A REPORT IN THE LAST DRAFT STAGE. THIS DEALS WITH WORK CONDUCTED OVER A TWO-YEAR PERIOD TO STUDY THE SUBLETHAL EFFECTS OF CHRONIC EXPOSURE TO OIL FROM NATURAL SEEPAGE AND INCLUDED BOTH INTERTIDAL AND SHALLOW SUBTIDAL SPECIES. IT WAS NOT DESIGNED AS A COMMUNITY STUDY, BUT AS A STUDY TO RELATE INDIVIDUAL SPECIES TO OIL. IT ALSO INCLUDED AN EXTENSIVE PROGRAM OF CHEMICAL ANALYSIS OF TISSUES AND SEDIMENTS.

SEVERAL MAJOR POINTS THAT EMERGED WERE THAT MARINE SPECIES CAN AND DO LIVE IN AREAS CHRONICALLY EXPOSED TO OIL. THIS INCLUDES BENTHIC SEDIMENTS. MOST OF THESE SPECIES HAVE PELAGIC LARVAL FORMS. THEREFORE, THIS CAN NOT BE REGARDED AS THE RESULTS OF NATURAL SELECTION OVER MANY GENERATIONS. THERE MAY INDEED BE AN INCREASE IN TOLERANCE TO OIL OF INDIVIDUALS THROUGH CHRONIC EXPOSURE AS WELL AS SELECTION OF THOSE MOST TOLERANT TO OIL FROM EACH GENERATION.

IN GENERAL, THE HIGHEST CONCENTRATION OF PETROLEUM HYDROCARBONS IN TISSUES WERE FOUND IN MYTILUS CALIFORNIANUS. EXAMINATION OF THE GONADS INDICATED THAT THE SPECIES WAS INDEED BREEDING AT COAL OIL POINT AND THAT OOCYTES AND EGGS APPEARED NORMAL IN THE OVARY. LIKEWISE, A STUDY OF THE EARLY STAGES OF LARVAL DEVELOPMENT IN SEA URCHINS, STRONGLYCENTROTUS SHOWED NO DETRIMENTAL EFFECTS EVEN THOUGH THE TISSUES OF THE PARENT ANIMALS CONTAINED PETROLEUM HYDROCARBONS.

THE AREA WAS ALSO NOT POPULATED WITH MALFORMED ORGANISMS. THIS INCLUDED A SURVEY OF ENCRUSTING BRYOZOANS FROM THE KELP CANOPY. CONTRARY TO THE OBSERVATIONS OF POWELL, ET AL (1970), NO HYPERPLASIA OF BRYOZOAN OVICELLS WAS RECORDED. COULD THE EFFECTS OBSERVED BY POWELL BE DUE TO SOME OTHER FACTOR OPERATING IN THEIR STUDY SUCH AS CREOSOTE--A COAL-TAR DERIVATIVE--WHICH HAS A HIGHER CANCER PRODUCING POTENTIAL THAN CRUDE OIL?

EXTERNAL PRESENCE OF BLACK OIL, HOWEVER, WAS ASSOCIATED WITH A REDUCTION OF THE BROODING RATE IN THE STALKED BARNACLE, POLLICIPES POLYMERUS. THIS APPEARED TO BE A TEMPERATURE EFFECT WITH THE OIL INCREASING THE ANIMAL'S BODY TEMPERATURE. HOWEVER, IN ALASKA WHERE THE SPECIES IS NEARER TO THE COLDER END OF THE RANGE, SUCH AN INCREASE IN TEMPERATURE MAY NOT BE SUFFICIENT TO REDUCE THE BROODING RATE.

OTHERS HAVE SURVEYED PRODUCTION AREAS (GURC, CALIFORNIA FISH AND GAME) AND LARGE PORTS (MILFORD HAVEN). THEIR DATA SHOW THAT THE INDUSTRY HAS INDEED BEEN ABLE TO OPERATE WITHOUT LARGE SCALE ENVIRONMENTAL DISRUPTION. ALL THESE OPERATIONS, HOWEVER, DO REQUIRE STRICT CONTROL BY INDUSTRIAL OPERATIONS TO MINIMIZE CONTAMINATION OF THE ENVIRONMENT. THE NEED FOR THIS CONTINUED CONTROL AND QUICK RESPONSE TO AN INCIDENT TO MAINTAIN CLEAN PORTS IS CONTINUALLY EMPHASIZED BY CAPTAIN DUDLEY, THE HARBOR MASTER AT MILFORD HAVEN.

I BELIEVE THAT THE OIL INDUSTRY CAN OPERATE WITHOUT CAUSING MAJOR ENVIRONMENTAL DISRUPTIONS. THOSE RISKS OF SHORT TERM DISRUPTION OF ISOLATED AREAS APPEAR SMALL WHEN COMPARED WITH THE GREATER WIDESPREAD BENEFITS THAT COULD BE GAINED FROM PRODUCTION OF THIS POTENTIAL ENERGY SOURCE.

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STATEMENT OF  
DR. ALBERT H. LASDAY  
VICE-CHAIRMAN, AMERICAN PETROLEUM INSTITUTE  
COMMITTEE ON FATE AND EFFECTS  
OF OIL IN THE ENVIRONMENT  
BEFORE THE HEARING OF  
THE U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
ON  
ENVIRONMENTAL IMPACT OF PROPOSED OIL AND GAS  
LEASING-OUTER CONTINENTAL SHELF, GULF OF ALASKA  
(OCS SALE NO. 39)  
AUGUST 12, 13, 1975  
AT ANCHORAGE, ALASKA

I am Dr. Albert H. Lasday, a Coordinator in Texaco Inc.'s Environmental Protection Department. One of my responsibilities is to advise on and to coordinate the Company's world-wide activities in prevention and control of water pollution, including oil spills.

I also serve as Vice Chairman of the American Petroleum Institute's Committee on Fate and Effects of Oil in the Environment. One of the Committee's sub-units is its Task Force on Physical Transport of Oil, of which I serve as Chairman. This latter group is concerned primarily with sponsoring and supervising, on behalf of the API, research which seeks to describe quantitatively the fate of spilled oil.

For the past seven and one-half years I have been occupied exclusively with water pollution problems. For the initial three and one-half years of that period I was Supervisor of Research at a Texaco laboratory where my section worked on various studies of waste water treatment and oil spill recovery and cleanup. Moreover, I have served as Texaco's Environmental Protection Coordinator at three significant oil spills in which my Company was involved (none of them off-shore), so that I am knowledgeable of the environmental aspects of events attendant on the accidental and unexpected release of large amounts of oil.

Detailed written comments on the "Draft Environmental Impact Statement for the Proposed OCS Oil and Gas Lease Sale-Northern Gulf of Alaska" will be submitted by the Gulf of Alaska Operators Committee. However, I shall comment today on several salient points contained in that document, regarding some of the effects on the environment of crude oil, of oil and gas drilling, and of production-related fluids, including drilling muds, drill cuttings, and produced brine.

WEATHERING AND DISSIPATION OF SPILLED CRUDE

Regarding the crude oil category, it is important, insofar as effects on marine biota are concerned, to distinguish between fresh and weathered oil, as the fresh crude contains components which are present in lesser amounts or even absent after weathering. Regardless of its source, a fresh crude entering a particular place in the marine environment will be transported somewhere else by winds, waves, and currents. During the time of transport, the characteristics and toxicity of the fresh crude are greatly modified by the weathering processes of evaporation, dissolution, photo-oxidation, emulsification, and biodegradation. Further, the operative transport mechanisms remove various components of the oil into other reservoirs such as the atmosphere, the water column, and the sediments.

Thus, any possible toxicity effect of crude oil entering the marine environment is rapidly decreased and effects on marine life much reduced after only a few hours time. This greatly reduced toxicity occurs soon at the original site, say of a spill, and consequently is even further reduced at any distant site to which the crude may be transported, due to the action of weathering and dissipative factors. Dr. Clayton D. McAuliffe discusses this subject of the fate of a spilled oil extensively and in detail in his presentation.

EFFECTS OF SPILLED OIL ON PHYTOPLANKTON

The "Draft Environmental Impact Statement" discusses effects of oil on phytoplankton in several places, and principally on pages 422-431. It is argued that both acute and chronic effects

of oil would be harmful to the phytoplankton population, that the phytoplankton are the ultimate basis of the marine food chain, and thus that any disruption or harmful effects on them would sequentially and adversely involve higher trophic levels. It is my purpose to make available some additional and new information regarding the effects of oil on phytoplankton, and to base some differing conclusions thereon.

Work funded by the American Petroleum Institute (API) and conducted by Ray and Mills at Texas A & M University showed that phytoplankton exposed to the water-soluble fractions of several test oils evidenced reduced primary productivity.<sup>1</sup> However, they noted that once the exposure to oil was terminated, the phytoplankton resumed a normal growth rate within a few days. They conclude that once a spill episode has passed, only a few cells need survive to repopulate a given area rapidly. Recruitment from nearby unaffected areas also would act to restore a normal phytoplankton population quickly. For these reasons, they report that phytoplankton have a great "rebound" potential.

In still other work funded by API, Strand and co-workers at Battelle-Northwest Research Laboratories report that at concentrations of oil less than 1 ppm, oil stimulated the growth of phytoplankton.<sup>2</sup> Other investigators have reported similar observations in Alaska<sup>3</sup>, France<sup>4</sup>, Canada<sup>5</sup>, and elsewhere.<sup>6,7</sup> Evidently at these low concentrations, oil serves as a nutrient.

Finally, The Gulf Universities Research Consortium (GURC) conducted an extensive environmental study<sup>8</sup> in the Gulf of Mexico utilizing control areas away from oil production, and study areas

with concentrated production activities. In his report to GURC<sup>24</sup>, Dr. S. Z. El Sayed states, "There is no evidence to suggest that production or drilling activities .... have had any deleterious effect on phytoplankton communities in the off-shore waters ...." Thus, it is concluded that, insofar as phytoplankton are concerned, any adverse effect of crude oil is temporary and that the phytoplankton regenerate quickly after a spill.

#### CHRONIC EXPOSURE OF MARINE LIFE TO SPILLED OIL

Another subject which is discussed in the "Draft Environmental Impact Statement" is that of the effects of long term, chronic exposure to crude oil. See, for example, the section expressing some of the more prevalent concerns, pages 395-404. Considerable speculation has also appeared both in the technical and in the popular literature on this subject. However, many comprehensive studies have been conducted or are in progress which show that such exposure is not harmful. The most extensive work has been done by the Gulf Universities Research Consortium.<sup>8</sup> The testimony of Mr. J. W. Tyson at this hearing reports that there have been no measurable adverse effects on marine life as a result of the off-shore oil operations in the Gulf of Mexico over the past 25 years or more.

A similar conclusion was reached by Battelle-Northwest Research Laboratories as a result of their three year study of Lake Maracaibo in Venezuela<sup>9</sup>, which has been impacted by off-shore operations for several decades. Further evidence is provided by studies conducted by Dr. Dale Straughan on the effects of the natural oil seeps off Coal Oil Point, Santa Barbara, upon the marine

community. She finds that the chronic exposure to oil from the natural seeps does not affect the health of the local marine animals in any way. Neither their growth rates nor their reproductivity are affected. Moreover, she finds no evidence of abnormal growths.<sup>10</sup>

Continuing in the same vein are the results being reported by the Bermuda Biological Station for Research from their study for the API on the effects on marine life of weathered oil washing ashore on some of the Bermuda beaches. So far, after more than a year's study, the researchers find no effects of oil on subtidal and intertidal marine life, nor are any effects observed upon the life that is inhabiting the splash zone.<sup>11</sup>

As a final study of chronic exposure of the marine environment to crude oil, I wish to report on the work being done in the Santa Barbara channel under the direction of Dr. John D. Isaacs of the Scripps Institution of Oceanography. This project, also sponsored by the API, is developing a census of various types of marine life under and adjacent to platforms Hilda and Hazel in the Santa Barbara channel. This census will be compared with a similar one conducted immediately after these platforms were constructed in 1959 and 1960. At the time of construction, very little marine life inhabited the area. Soon after construction, the fish population had grown to about 6,000 under each platform. The structures had become encrusted with sessile organisms, such as mussels and barnacles, but no marine life was present in or on the sterile drill cuttings deposited at the base of the platforms.<sup>12</sup>

Today the fish populations are estimated at more than 20,000 under each platform. The structures are heavily encrusted by sessile organisms. Also, the drill cutting piles have become a teeming community of benthic life.<sup>13</sup>

These studies provide graphic evidence that there are little, if any, adverse effects upon marine life from chronic exposure to crude oil. On the contrary, they provide good evidence that such off-shore platform structures provide an environment that increases the total biomass for their local area.

Except in confined bodies of water where, for example, sediments can become heavily contaminated, oil has a negligible effect upon marine life. Undoubtedly the major factors responsible for this condition are the very low solubility of oil in water and the rapid dilution which occurs. Most toxic levels of oil involve concentrations measured in the many parts per million range, up to hundreds of parts per million, whereas the concentration of oil in the natural environment lies in the parts per billion range. For example, scientists of the Bedford Institute in Nova Scotia have found hydrocarbon levels in the range of only 1 to 6 parts per billion in waters off the Canadian East Coast.<sup>14,15</sup> Tanker routes in the Atlantic Ocean contain only 2 to 20 parts per billion of hydrocarbon.<sup>16</sup> The hydrocarbon content of the water column affected by the natural seeps near Coal Oil Point at Santa Barbara is, at most, 16 parts per billion.<sup>17</sup> In the studies of the 1970 platform spill in the Gulf of Mexico, the concentrations of hydrocarbon were only 200 parts per billion at the platform and had dwindled to only 1 part per billion a mile away.<sup>18</sup> It is small wonder, therefore, that such low levels of exposure, especially in areas of open moving water, do not significantly affect marine life to any measurable degree.

LABORATORY BIOASSAY VS. REALISTIC CONDITIONS

Laboratory bioassay has been a primary investigative method from which have been derived the results and conclusions which are discussed in the "Draft Environmental Impact Statement," in the sections on the effects of oil on phytoplankton, and the long-term chronic exposure effects of oil. Because of the importance of the conclusions which have been based largely on laboratory bioassay testing, it is necessary to question the validity of that test procedure. Important observations concerning this were made at the API-sponsored Fate of Oil Symposium, May 29-30, 1974, in Washington, D.C. The several contractors conducting research for API on fate and effects of oil reviewed publicly the results they have obtained. A copy of the program is attached.

Significantly, each of the contractors emphasized that results from laboratory bioassay testing cannot be used as a direct measure of the toxic effects that may be expected in a "real world" circumstance. This is especially difficult with oil because it is for the most part insoluble in water. Therefore, a uniform distribution throughout the water is virtually never realized. In the case of oil, evaporation occurs; and, consequently, the lighter fractions are quickly removed. Moreover, in the "real world," dilution also occurs rapidly. In bioassay work, on the other hand, the concentration of a contaminant is held constant throughout the duration of the test, usually 96 hours. This is an unrealistically long time in the case of most spills in marine waters where the exposure time for a given local area is brief, often only a matter of hours, because the spilled oil is being moved by winds, waves, and currents.

Furthermore, the loss of fin fish is seldom observed in an oil spill in the marine environment even though a significant susceptibility is measured by laboratory bioassay work. This anomaly exists because in bioassay work the test fish is confined to a given volume of water, whereas, in marine waters, the fish can escape after evidently sensing the oil. This lack of correlation between bioassay work and field results is generally recognized. For example, the Marine Technology Society in April of this year conducted a workshop to assess this problem and to recommend needed research. Also, this deficiency was emphasized as a problem in a workshop sponsored last year by the Institute of Petroleum in England.<sup>19</sup>

As a result of the experiences of and conclusions reached by its contract research organizations, as well as by the observations of others, the API is placing maximum emphasis on field studies in its continuing sponsorship of research concerning the effects of oil. It is therefore recommended that any revisions to the "Draft Environmental Impact Statement" place increased emphasis on the results of field studies, and very cautiously evaluate the conclusions based on laboratory bioassay experiments.

#### EFFECTS OF DRILLING MUDS ON MARINE ORGANISMS

Drilling muds are identified in the "Draft Environmental Impact Statement" (pages 341-343, 417-418) as having possibly undesirable effects due to toxicity of some components and to turbidity. Let's now address ourselves to some additional information regarding drilling muds.

Drilling muds are complex mixtures of many different components. The toxicity of these components varies widely when tested individually. However, the most toxic components are used only sparingly in the formulation of the drilling muds. The low concentrations of such components in the muds are reflected in the high concentrations of mud in the receiving waters that are needed to produce a toxic effect.

This conclusion is illustrated by the work reported by Logan, Sprague, and Hicks of the University of Guelph in Ontario, Canada<sup>20</sup> and summarized by Falk and Lawrence.<sup>21</sup> Logan and coworkers determined by laboratory methods the LC50 (the lethal concentration of drilling mud in water needed to kill half of their test organisms) after an exposure of 96 hours. Their test organisms were lake chub and rainbow trout. The LC50's for a 96-hour exposure period ranged from 0.83% to 12.0%. Thus, since such high concentrations of drilling mud in water are required in order to demonstrate toxic effects, only moderate dilution, depending on the drilling mud being used, would be needed to render the mud non-toxic even for a 96-hour exposure period. The currents that normally exist around a platform would achieve this degree of dilution within a few feet of the point of discharge and within an elapsed time of only a few minutes. Thus, the effect of discharging drilling muds upon the health of a marine ecosystem can be considered negligible.<sup>22</sup> But one must bear in mind the limitations of laboratory bioassays, as discussed above.

The "Draft Environmental Impact Statement" expresses specific concern about the ferrochrome lignosulfonates and barite

used in the formulation of drilling muds. Logan et al<sup>20</sup> report the toxicity level of ferrochrome lignosulfonate to be about 1500 ppm, or about 0.15%. Since it is used sparingly in the formulation of drilling muds, its concentration in the water after discharge of the mud is very low and therefore non-toxic.

Further, the "Draft Environmental Impact Statement" states that an unknown factor is the toxicity to benthic organisms from barium compounds in drilling muds. While these compounds are a major component in drilling muds, Logan et al<sup>20</sup> report their toxicity to be extremely low, essentially zero. As observed above, the rapid dilution by seawater at the point of discharge of the mud renders components non-toxic almost instantaneously. F. T. Weiss<sup>23</sup> observed in his testimony before the Bureau of Land Management hearing in Los Angeles last May that these same barium compounds are the principal ingredients in the "barium enema" or "barium diet" used for X-ray examinations. While they may be unpleasant, they can hardly be considered as toxic materials!

#### EFFECTS OF PRODUCED WATER DISCHARGES

The discharge from producing platforms of formation waters is discussed in the "Draft Environmental Impact Statement" (for example, pages 342-5, 424) and it is concluded that the impact will not likely be significant, based on dilution of produced waters in the ocean water column, and the patchiness of phytoplankton production in the northern sector of the Gulf of Alaska. In support of that conclusion, it should be noted that an important component of discharged water from a producing platform is oil -- in the 10 to 50 parts per million range -- and as discussed above, chronic exposure of phytoplankton and other marine organisms to low levels

of crude oil is not harmful. In addition to minor amounts of entrained oil, some additional characteristics of produced water noted in the "Draft Environmental Impact Statement" are high salinity, and presence of various metals and non-metals.

Regarding salinity, the GURC study<sup>8</sup> previously mentioned reported salinity measurements at 180 sampling locations in the northern Gulf of Mexico. The observed levels were reported to be within normal ranges according to season of the year. Of course, dilution is the method of detoxification. Dr. J. F. Mackin<sup>25</sup> said, "This dilution in large water bodies and comparatively deep water is almost instantaneous, and dilutions of 1,000 parts of sea water to one of brine can be effected in even comparatively shallow water in distances of from 8 to 50 feet. In off-shore waters in the Gulf or elsewhere, there is no brine problem for that reason."

Various metals and non-metals present in produced water are listed in Table 45a, page 344 of the "Draft Environmental Impact Statement." In addition, trace amounts of other metals have been listed.<sup>26</sup> While all of the trace elements discovered in brines are present in sea water, some of the former could be discharged at higher concentrations. As previously discussed with respect to salinity, dilution would very rapidly, and in a very short distance, render harmless any brine discharge containing even an otherwise toxic concentration of a heavy metal.

SUMMARY AND CONCLUSIONS

In summary, the following conclusions have been stated in my testimony:

1. Any adverse effect of crude oil on phytoplankton is temporary as they regenerate and repopulate quickly after a spill.
2. Chronic exposure of marine life to low levels of petroleum hydrocarbons from crude oil entering the environment does not significantly affect the biota.
3. Laboratory bioassay testing does not simulate the "real world" in any reasonable fashion and, therefore, the results of such studies must be interpreted and applied with extreme caution. "Real world" field studies are a much preferred investigatory route for determining the effects of oil on marine flora and fauna.
4. Drilling muds may contain some additives which are toxic if concentrated; however, in actual practice, rapid dilution in the water column, should they be discharged, renders them negligibly harmful to marine life.
5. At time of discharge, ocean bottom areas covered with drill cuttings will be sterile, but a thriving benthic population will develop.
6. The discharge of formation waters into the ocean from producing platforms does not present any hazard to sea life forms in the water column near the platforms, due to the rapid dilution which occurs.

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PRELIMINARY PROGRAM AND INVITATION

SYMPOSIUM ON

FATE AND BIOLOGICAL EFFECTS  
OF OIL SPILLED IN THE MARINE ENVIRONMENT

Sheraton-Park Hotel, Washington, D.C.

May 29-30, 1974



Sponsored by  
The American Petroleum Institute

SYMPOSIUM ON  
FATE AND BIOLOGICAL EFFECTS  
OF OIL SPILLED IN THE MARINE ENVIRONMENT

In 1971, after a careful evaluation of published documents on the fate of oil spills and their ecological/biological effects, the American Petroleum Institute determined that there was a dearth of scientific knowledge on this subject. It was found that the literature was frequently speculative, and contained little experimental evidence. Furthermore, many far-reaching questions of importance to the petroleum industry could not be answered for lack of factual information.

API then launched a comprehensive research program to get these answers. This program has grown during the past three years, and has begun to provide much scientific data on the fate and effects of oil.

To provide a forum for the presentation and discussion of these data by the scientists who are conducting the research, API has scheduled this symposium. It is the hope of API's Task Force on Fate of Oil that this symposium will promote objective evaluation of these projects and the information developed by them. The net result should be of benefit to the scientists involved, to API, and to all who share an interest in the area.

PROGRAM TOPICS AND SPEAKERS

Physical Transport of Spilled Oil

Dr. R. L. Kolpack  
University of Southern California

Chemical Analysis for Oil in Water,  
Sediments, and Tissues

Dr. J. S. Warner  
Battelle Memorial Institute  
Columbus (Ohio) Laboratories

Biodegradation of Oil

Dr. Rita R. Colwell  
University of Maryland

Dr. Leon Petrakis  
Gulf Research & Development Co.

Effects of Oil on Phytoplankton

Dr. J. R. Vanderhorst  
Battelle Memorial Institute  
Pacific Northwest Laboratories

Dr. S. M. Ray  
Texas A. & M. University

Toxicity of Oil to Marine Fauna  
(Flow-Through Bioassay Technique)

Dr. B. E. Vaughan  
Battelle Memorial Institute  
Pacific Northwest Laboratories

Toxicity of Oil to Marine Fauna  
(Static Bioassay Techniques)

Dr. J. W. Anderson  
Texas A. & M. University

Avian Physiology Research

Dr. W. N. Holmes, Jr.  
University of California at  
Santa Barbara

Field Studies, Bermuda

Dr. C. D. Gebelein  
Bermuda Biological Station for  
Research

Field Studies, Santa Barbara

Dr. Dale Straughan  
Allan Hancock Foundation  
University of California

Field Studies, Buzzards Bay

Dr. A. D. Michael  
Marine Biological Laboratory  
Woods Hole, Massachusetts

Analytical Method for  
Polynuclear Aromatics

Dr. R. A. Brown  
Esso Research & Engineering Co.  
Linden, New Jersey

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Direct requests for additional  
Symposium information to:

Dr. J. R. Gould  
Conference Coordinator  
Fate and Effects Symposium  
Suite 700  
1629 K Street, N. W.  
Washington, D. C. 20006  
(202) 296-3018

#### GENERAL SYMPOSIUM INFORMATION

Registration: Attendance at this symposium is by invitation only. All invitees who wish to attend must register in advance. Please complete the enclosed registration card and return by April 10, 1974, with your check (made payable to American Petroleum Institute) to:

Fate and Effects Symposium  
Suite 700  
1629 K Street, N. W.  
Washington, D. C. 20006

Your badge and meeting materials will be held for you at the Symposium Registration Desk (Cotillion Room Foyer, Sheraton-Park Hotel) which will be open as follows:  
Tuesday, May 28, 6:00 p.m.-8:00 p.m. and  
Wednesday, May 29, 8:00 a.m. - noon.

Only those who have registered in advance will be able to attend the symposium sessions.

Luncheon: A luncheon is scheduled for Wednesday, May 29, and is included in your registration fee.

Hotel Reservations: A block of rooms at the Sheraton-Park Hotel has been set aside for participants. To ensure confirmed reservations from this block, your request must be RECEIVED BY THE HOTEL no later than May 8, 1974. The hotel reservation card (enclosed) must be mailed as soon as possible to: Sheraton-Park Hotel, Washington, D. C. 20008. An advance deposit or written guarantee of payment is necessary to hold your room if arrival is scheduled after 6:00 p.m. Available accommodations are: Single Rooms \$25.00; Double (Twin) Rooms \$33.00.

Message Center: A Message Center will be in operation May 29 from 8:00 a.m. to 5:00 p.m. and May 30 from 8:00 a.m. to 1:00 p.m. Please suggest that callers who wish to reach you during these hours

ask the hotel operator (202-265-2000) for the Fate and Effects Symposium Message Center. Please check the Message Board periodically.

Badges: Badges are required for admittance to all meetings. Please wear your badge at all times so you will not be delayed at the entrance to a meeting.

#### NOTES

STATEMENT OF

JESSE P. JOHNSON  
MANAGER, SOUTH ALASKA DISTRICT

ATLANTIC RICHFIELD COMPANY

before the

U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

HEARING ON

PROPOSED OIL AND GAS LEASING

on the

OUTER CONTINENTAL SHELF

NORTHERN GULF OF ALASKA

ANCHORAGE, ALASKA

AUGUST 12-13, 1975

STATEMENT OF JESSE P. JOHNSON, ATLANTIC RICHFIELD COMPANY

OFFSHORE SALE ENVIRONMENTAL HEARING

ANCHORAGE, ALASKA

MY NAME IS JESSE JOHNSON, THE MANAGER OF ATLANTIC RICHFIELD COMPANY'S SOUTH ALASKA DISTRICT. I AM RESPONSIBLE FOR COMPANY OPERATIONS IN SOUTH ALASKA WHICH INCLUDE OUR OPERATIONS IN COOK INLET AND FUTURE COMPANY OPERATIONS IN THE GULF OF ALASKA. I REPRESENT MY COMPANY ON THE GULF OF ALASKA OPERATORS COMMITTEE.

OTHER TESTIMONY EMPHASIZES THAT MEASURES WILL BE TAKEN TO PREVENT OIL SPILLS. THESE MEASURES INCLUDE TRAINING TO REDUCE THE NUMBER OF HUMAN ERRORS, THE INSTALLATION OF SAFETY EQUIPMENT AND POLLUTION PREVENTION EQUIPMENT, AND IMPLEMENTING OPERATION AND INSPECTION PROCEDURES TO ENSURE PROPER FUNCTIONING OF THIS EQUIPMENT. ALTHOUGH WE ARE CONFIDENT THAT SUCH MEASURES WILL PREVENT OIL SPILLS, WE WILL TAKE ADDITIONAL PRECAUTIONS TO PREPARE FOR SUCH AN UNLIKELY EVENT BY PROVIDING PHYSICAL CONTAINMENT (OR SECONDARY CONTAINMENT) WHERE APPLICABLE. THESE MEASURES WOULD BE TAILORED TO THE PARTICULAR FACILITY AFTER A CAREFUL ASSESSMENT OF THE POSSIBILITY OF A DISCHARGE OF OIL.

IF A SPILL OCCURS, OUR IMMEDIATE OBJECTIVE WILL BE TO MINIMIZE ANY RESULTING DAMAGE. EQUIPMENT AND TECHNIQUES FOR DOING THIS HAVE BEEN DEVELOPED AND ARE THE SUBJECT OF MUCH CURRENT RESEARCH. BOTH THE INDUSTRY

AND THE GOVERNMENT HAVE FUNDED, AND ARE CONTINUING TO FUND, PROJECTS TO DEVELOP NEW AND IMPROVED SKIMMING DEVICES, CONTAINMENT BOOMS, AND DISPERSANTS. THE MOST THOROUGH AND CURRENT SINGLE REVIEW AND ASSESSMENT OF THE TECHNOLOGY RESULTING FROM SUCH RESEARCH CAN BE FOUND IN THE PUBLICATIONS OF THE CONFERENCE ON PREVENTION AND CONTROL OF OIL POLLUTION. THE MOST RECENT OF THESE CONFERENCES WAS HELD IN SAN FRANCISCO IN MARCH OF THIS YEAR. THESE CONFERENCES ARE JOINTLY SPONSORED BY THE ENVIRONMENTAL PROTECTION AGENCY, THE UNITED STATES COAST GUARD, AND THE AMERICAN PETROLEUM INSTITUTE.

IN ADDITION TO SUCH TECHNOLOGICAL ADVANCES, THE INDUSTRY IS WORKING IN ANOTHER AREA THAT I CONSIDER EQUALLY IMPORTANT, WHICH IS THE ABILITY TO APPLY TECHNOLOGY RAPIDLY AND EFFECTIVELY. THROUGH THE AUSPICES OF THE AMERICAN PETROLEUM INSTITUTE, AN OIL SPILL SUBCOMMITTEE IS BUILDING EXPERTISE WITHIN THE INDUSTRY. THE API CONTRACTED WITH TEXAS A & M UNIVERSITY TO DEVELOP AN OIL SPILL CONTROL SCHOOL. THE PURPOSE OF THE SCHOOL IS TO TRAIN INDUSTRY PERSONNEL IN SPILL PREVENTION, CONTROL, AND CLEAN-UP TECHNIQUES. A BROCHURE DESCRIBING THE TEXAS A & M SCHOOL IS BEING SUPPLIED WITH THIS STATEMENT FOR THE PERMANENT RECORD. THE SCHOOL BEGAN THIS YEAR, AND A MINIMUM OF 20 SESSIONS WILL BE OFFERED EACH YEAR. THE SCHOOL IS CONDUCTED INDEPENDENTLY OF THE API.

MUCH OF THE PROGRESS IN THE APPLICATION OF CLEAN-UP TECHNIQUES IS DUE TO THE FORMATION OF OIL SPILL COOPERATIVES. COOPERATIVES ENABLE THEIR

MEMBERS TO POOL THEIR RESOURCES, SUCH AS EQUIPMENT, MACHINERY, SUPPLIES AND PERSONNEL. THE COOPERATIVE ITSELF CAN OWN SPECIALIZED EQUIPMENT NOT OWNED BY INDIVIDUAL MEMBERS. SOME OF THESE ORGANIZATIONS PROVIDE THEIR OWN SCHOOLS FOR TRAINING AND DRILLS.

COOPERATIVES HAVE RANGED FROM AN EXCHANGE OF TELEPHONE NUMBERS AND PROMISES OF AID TO TODAY'S MORE SOPHISTICATED COOPERATIVES WHICH ARE COVERED BY WRITTEN AGREEMENTS. A 1972 SURVEY CONDUCTED BY THE AMERICAN PETROLEUM INSTITUTE REVEALED THAT THERE WERE 100 SUCH COOPERATIVES THEN IN EXISTENCE, SUCH AS IN THE LOS ANGELES AREA, HUMBOLT BAY, SAN FRANCISCO BAY, COLUMBIA RIVER AREA IN OREGON, PUGET SOUND AND COOK INLET, ALASKA. ABOUT HALF OF THESE GROUPS WERE COMPOSED OF PETROLEUM COMPANIES ONLY. HOWEVER, MEMBERSHIP IS NOT LIMITED TO PETROLEUM COMPANIES AND OTHERS IN NEED OF COOPERATIVE SERVICES CAN JOIN.

IN ALASKA, TERMINAL OPERATORS, OFFSHORE CRUDE OIL DRILLERS AND PRODUCERS, AND AN ONSHORE CRUDE OIL DRILLER AND PRODUCER, JOINED TOGETHER TO FORM THE COOK INLET OIL SPILL COOPERATIVE. THE EXPERIENCES OF THAT COOPERATIVE WILL BE INVALUABLE TO THE GULF OF ALASKA CLEAN-UP COOPERATIVE.

THE MOST IMPORTANT REASON FOR THE ORGANIZING OF AN OIL SPILL COOPERATIVE IS TO DEVELOP AN INTEGRATED RESPONSE PLAN UTILIZING THE LARGEST POSSIBLE POOL OF EXPERTISE, EQUIPMENT, AND MANPOWER. BY SO DOING, THE TOTAL INDUSTRY EXPERTISE IN A GIVEN AREA IS USED IN PROMOTING READINESS AND

EFFECTIVENESS IN OIL SPILL PREVENTION AND CLEAN-UP. THE EQUIPMENT IS AVAILABLE IN THREE GENERAL WAYS. FIRST, A COOPERATIVE MAINTAINS AN INVENTORY OF THE EQUIPMENT AND MATERIALS OWNED BY INDIVIDUAL MEMBERS. SECOND, A SIMILAR INVENTORY IS MAINTAINED LISTING EQUIPMENT AND MATERIALS AVAILABLE FROM OTHER SOURCES SUCH AS SUPPLIERS AND RENTAL FIRMS. THIRD, SPECIALIZED EQUIPMENT NOT NORMALLY OWNED BY INDIVIDUAL MEMBERS IS PURCHASED BY THE COOPERATIVE. THE EQUIPMENT OWNED BY THE COOPERATIVE CAN BE MADE AVAILABLE TO NON-MEMBERS. THIS PROVISION CAN BE INCLUDED IN THE AGREEMENT. ALSO, ALL EQUIPMENT OWNED BY THE COOPERATIVE IS AVAILABLE TO THE UNITED STATES COAST GUARD. THE COAST GUARD TAKES CHARGE OF CLEANING UP SPILLS OF UNDETERMINED ORIGIN.

EFFORTS BY THE GULF OF ALASKA OPERATORS COMMITTEE HAVE RESULTED IN 24 COMPANIES COMMITTING TO THE GULF OF ALASKA CLEAN-UP COOPERATIVE. THE REPRESENTATIVES OF THESE COMPANIES MET ON AUGUST 8 AND TRANSACTED BUSINESS NECESSARY TO FORMALLY ORGANIZE AND APPOINT WORK COMMITTEES NECESSARY TO FULFILL THE RESPONSIBILITY OF PROVIDING EQUIPMENT, OPERATING PROCEDURES, AND TRAINING NECESSARY TO CLEAN UP AN OIL SPILL IN THE GULF OF ALASKA. A FIVE-MAN EXECUTIVE COMMITTEE, INCLUDING MYSELF AS CHAIRMAN OF THE CO-OP, WAS ELECTED. A LEGAL SUBCOMMITTEE WAS APPOINTED TO RECEIVE COMMENTS AND MAKE NECESSARY CHANGES IN THE DRAFT AGREEMENT WHICH IS BEING FILED WITH THIS STATEMENT. AN ENGINEERING COMMITTEE WAS APPOINTED TO REVIEW CLEAN-UP EQUIPMENT AND PROVIDE A RECOMMENDATION FOR OBTAINING SAME FOR

THE COOPERATIVE. INVENTORIES CARRIED BY SEVERAL EXISTING COOPERATIVES ARE BEING FILED WITH THIS STATEMENT AS EXAMPLES OF EQUIPMENT TO BE CONSIDERED. THE NEED FOR SPECIAL OR LARGER VERSIONS OF SKIMMING EQUIPMENT NOW BEING USED HAS BEEN REVIEWED BY THE GULF OF ALASKA OPERATORS COMMITTEE AND THE CO-OP ENGINEERING SUBCOMMITTEE WILL TAKE OVER THE RESPONSIBILITY OF OBSERVING THE TEST TANK MODEL STUDIES BY MARCO POLLUTION CONTROL. THIS WILL BE DONE TO DETERMINE A SUITABLE SELF-PROPELLED SKIMMING VESSEL FOR USE IN THE GULF OF ALASKA. THE MODEL TESTING OF TWO-HULL CONCEPTS WILL BE COMPLETED THE END OF THIS MONTH (AUGUST) AND A REPORT WITH RECOMMENDATIONS WILL BE COMPLETED THE END OF SEPTEMBER. THE GULF OF ALASKA CLEAN-UP COOPERATIVE IS EXPECTED TO COMMIT FOR ENGINEERING DESIGN AND DRAWINGS AND THEN FOR THE CONSTRUCTION OF THE OPEN OCEAN SKIMMING VESSEL. WHEN BUILT, THIS SKIMMER, TO OUR KNOWLEDGE, WOULD BE THE LARGEST SUCH VESSEL IN OPERATION IN OCS WATERS.

THE OPEN OCEAN SKIMMING VESSEL IS THE TYPE OF SPECIALIZED EQUIPMENT OWNED OR CONTRACTED FOR BY A COOPERATIVE. IN ADDITION, THE COOPERATIVE WILL PROVIDE FOR CONTAINMENT BOOMS, SORBENT MATERIALS, SURFACE TENSION MODIFIERS TO RETARD THE NATURAL TENDENCY OF OIL TO SPREAD RAPIDLY ON THE WATER SURFACE, AND THE EQUIPMENT TO DEPLOY AND USE THESE MATERIALS. THE COOPERATIVE, OR THE COMPANIES OPERATING SHORE-SIDE SUPPLY BASES, WILL PROVIDE OIL SPILL CONTAINMENT AND CLEAN-UP EQUIPMENT FOR SPILLS WHICH MAY OCCUR AT THESE BASES. AT THE PRESENT TIME, SHORE-SIDE SUPPLY BASES ARE PLANNED AT YAKUTAT AND CORDOVA.

I WILL NOW SHOW SOME SLIDES DEPICTING SOME OF THIS EQUIPMENT. PHOTOGRAPHS DEPICTING THIS EQUIPMENT ARE BEING SUPPLIED FOR THE PERMANENT RECORD. (SEE ATTACHMENT "A" FOR DESCRIPTIONS.)

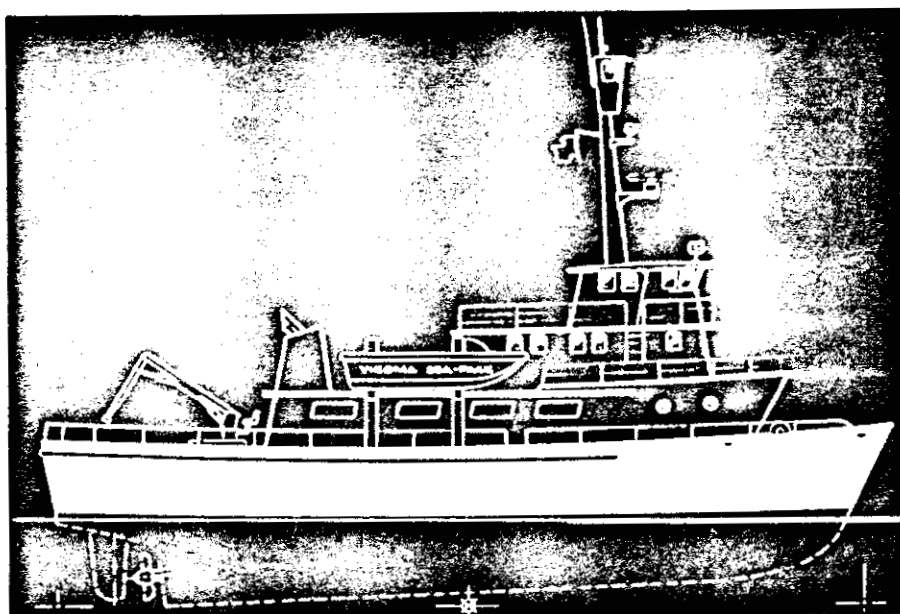
IN SUMMARY, PRECAUTIONS WILL BE TAKEN TO PREVENT OIL SPILLS AND, IN THE UNLIKELY EVENT A SPILL DOES OCCUR, CONTINGENCY PLANS AND A COOPERATIVE WILL BE IN EFFECT TO RESPOND PROMPTLY AND THOROUGHLY. INITIALLY THE PLANS AND EQUIPMENT WILL BE THOSE NECESSARY DURING EXPLORATORY DRILLING OPERATIONS. EXPANSION OF THE CO-OP WILL OCCUR, IF AND WHEN COMMERCIAL PRODUCTION IS ESTABLISHED, TO INCLUDE PRODUCTION PLATFORMS, OFFSHORE AND/OR ONSHORE CRUDE OIL SHIPPING TERMINALS, PIPELINES, SHORE-SIDE SUPPLY BASES, AND ALL SUCH ACTIVITIES DEVELOPED TO PRODUCE CRUDE OIL AND GAS IN THE GULF OF ALASKA.

ATTACHMENT "A"

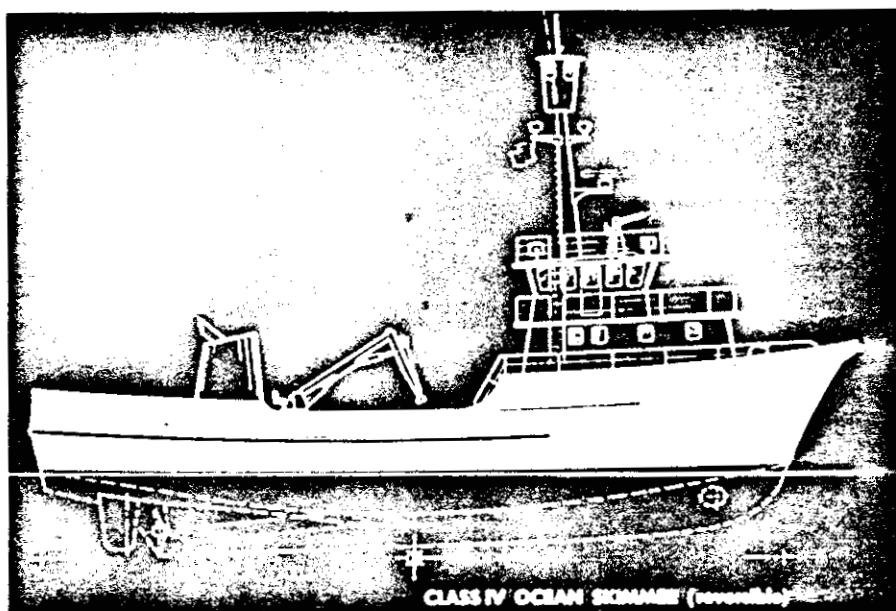
<u>SLIDE NUMBER</u>	<u>DESCRIPTION</u>																						
1.	<p><u>Open Ocean Skimmer.</u> Conceptual outboard profile of Marco Class VI Catamaran ship to be model tested for the GOAOC.</p> <table><tr><td>Length O. A.:</td><td>108' -0"</td></tr><tr><td>Beam O. A.:</td><td>40' -0"</td></tr><tr><td>Displacement:</td><td>300 Long Tons</td></tr><tr><td>Sweep Width</td><td></td></tr><tr><td>    Free:</td><td>28'</td></tr><tr><td>    With Water Spray Boom:</td><td>60'</td></tr><tr><td>Oil Slops Capacity:</td><td>1000 Barrels</td></tr><tr><td>Horsepower:</td><td>1500 to 2200</td></tr><tr><td>Range:</td><td>3250 Miles @ 13 Knots</td></tr><tr><td></td><td>2300 Miles @ 14 Knots</td></tr><tr><td>Crew Accommodations:</td><td>7 (5 required)</td></tr></table>	Length O. A.:	108' -0"	Beam O. A.:	40' -0"	Displacement:	300 Long Tons	Sweep Width		Free:	28'	With Water Spray Boom:	60'	Oil Slops Capacity:	1000 Barrels	Horsepower:	1500 to 2200	Range:	3250 Miles @ 13 Knots		2300 Miles @ 14 Knots	Crew Accommodations:	7 (5 required)
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Crew Accommodations:	7 (5 required)																						
2.	<p><u>Open Ocean Skimmer.</u> Conceptual outboard board profile of Marco Class IV reversible ship. Combination monohull-Catamaran Marco design to be model tested for the GOAOC.</p> <table><tr><td>Length:</td><td>106' -0"</td></tr><tr><td>Beam O. A.:</td><td>30' -0"</td></tr><tr><td>Displacement:</td><td>275 Long Tons</td></tr><tr><td>Sweep Width</td><td></td></tr><tr><td>    Free:</td><td>20'</td></tr><tr><td>    With Water Spray Boom:</td><td>50'</td></tr><tr><td>Oil Slops Capacity:</td><td>1000 Barrels</td></tr><tr><td>Horsepower:</td><td>850</td></tr><tr><td>Range:</td><td>4000 Miles @ 12 Knots</td></tr><tr><td>Crew Accommodations:</td><td>7 (5 required)</td></tr></table>	Length:	106' -0"	Beam O. A.:	30' -0"	Displacement:	275 Long Tons	Sweep Width		Free:	20'	With Water Spray Boom:	50'	Oil Slops Capacity:	1000 Barrels	Horsepower:	850	Range:	4000 Miles @ 12 Knots	Crew Accommodations:	7 (5 required)		
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3.	<p><u>Catamaran Harbor and Bay Skimmer.</u> Profile of Marco Class III skimmer in use in San Francisco Bay Area by Clean Bay, Inc. Experience gained with this skimmer will be used in the design of the skimmers in Slides 1 and 2.</p>																						
4.	<p><u>Catamaran Harbor and Bay Skimmer.</u> Bow view of Marco Class III skimmer in use by Clean Bay, Inc. in the San Francisco Bay Area by Clean Bay, Inc. showing water spray booms. The water spray booms increase the sweep width from 16' (free) to 45'.</p>																						
5.	<p><u>Vikoma Sea Pack Containment Boom.</u> Fast response containment boom. The containment boom and inflation equipment are contained in a 23 foot boat hull. Boom lengths up to 1600 feet. Transportable by air or highway and can be towed on the water at speeds up to 4 knots. Boom is deployed from boat hull at the spill site.</p>																						

<u>SLIDE NUMBER</u>	<u>DESCRIPTION</u>
6.	<u>Vikoma Sea Pack Containment Boom.</u> Boom deployed.
7.	<u>Vikoma Sea Pack Containment Boom.</u> Boom deployed.
8.	<u>Containment Boom in Storage Trailer.</u> Fabric reinforced plastic skirt boom with plastic foam floats. Trailer stows 1000 feet of boom, floating type oil skimmers and pump. Air and highway transportable.
9.	<u>Containment Boom Deployed.</u> Boom in Slide 8. deployed.
10.	<u>Floating Skimmers.</u> Skimmers of the type stowed in trailer in Slide 8. Skimmers are effective in shallow water to 3" depth for use along shore lines. Floats keep hose on the water.
11.	<u>Containment Boom in Storage Boxes.</u> Fabric reinforced plastic boom with plastic foam floats. Open ocean boom. Each box contains 100 feet of boom.
12.	<u>Containment Boom Deployed.</u> Boom in previous slide deployed.
13.	<u>Sorbent Boom.</u> Preferentially absorbs oil and repels water. Absorbs crude oils, fuel oils, and lubricating oils.
14.	<u>Sorbent Boom Deployed.</u>
15.	<u>Sorbent Sheets.</u> Preferentially absorb oil and repel water. Absorb crude oil, fuel oils, and lubricating oils.

ATTACHMENT "A"

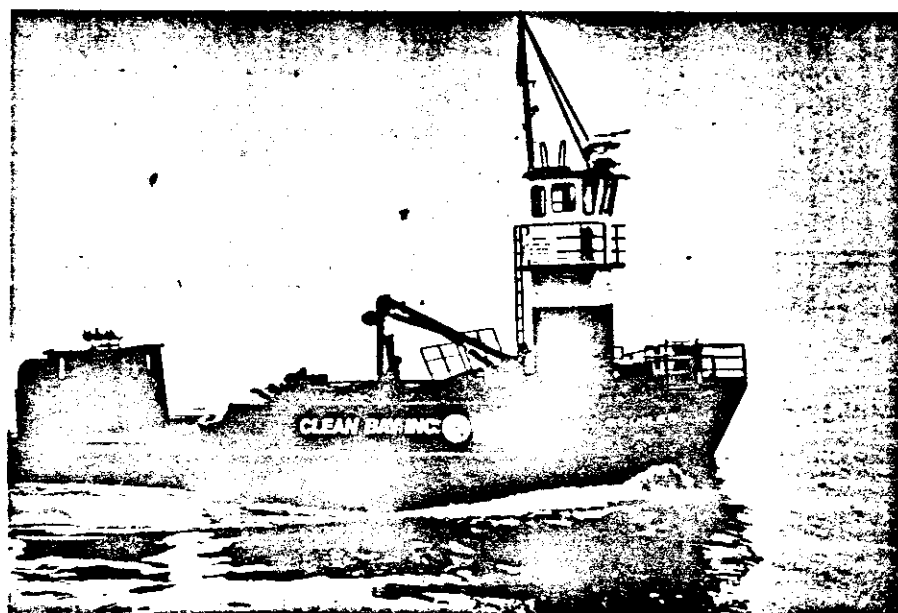


SLIDE - PHOTO 1.  
OPEN OCEAN SKIMMER

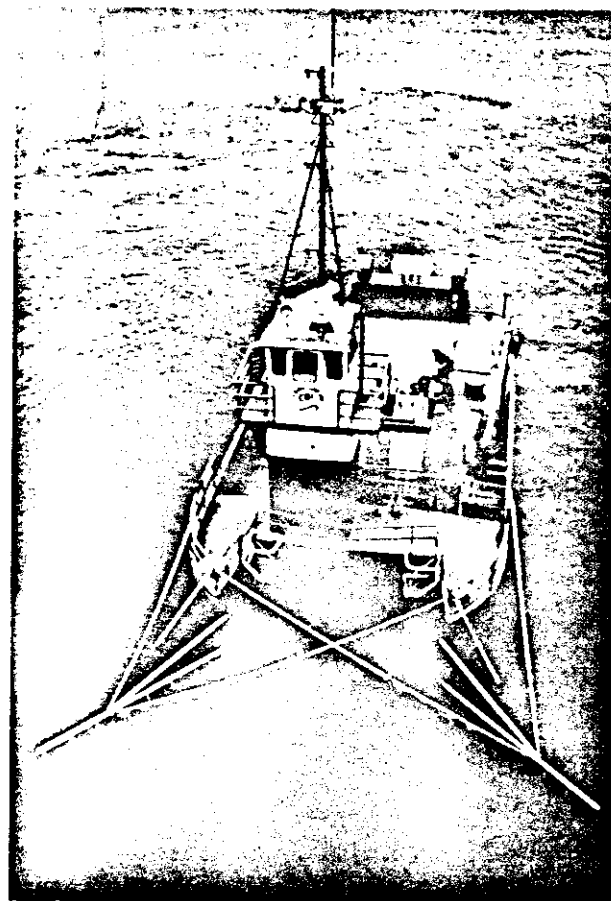


SLIDE - PHOTO 2.  
OPEN OCEAN SKIMMER

ATTACHMENT "A"

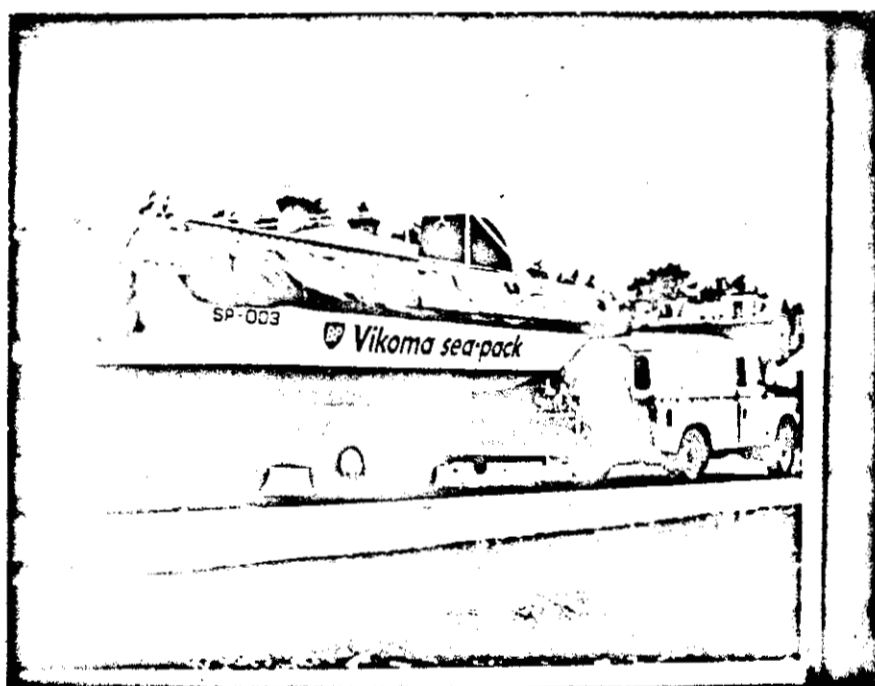


SLIDE - PHOTO 3.  
CATAMARAN HARBOR AND BAY SKIMMER

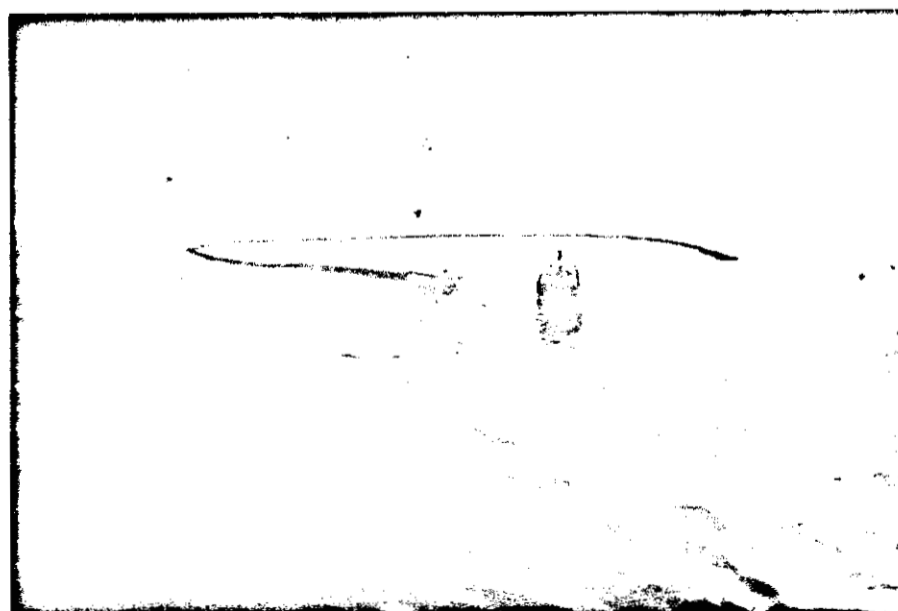


SLIDE - PHOTO 4.  
CATAMARAN HARBOR  
AND BAY SKIMMER

ATTACHMENT "A"

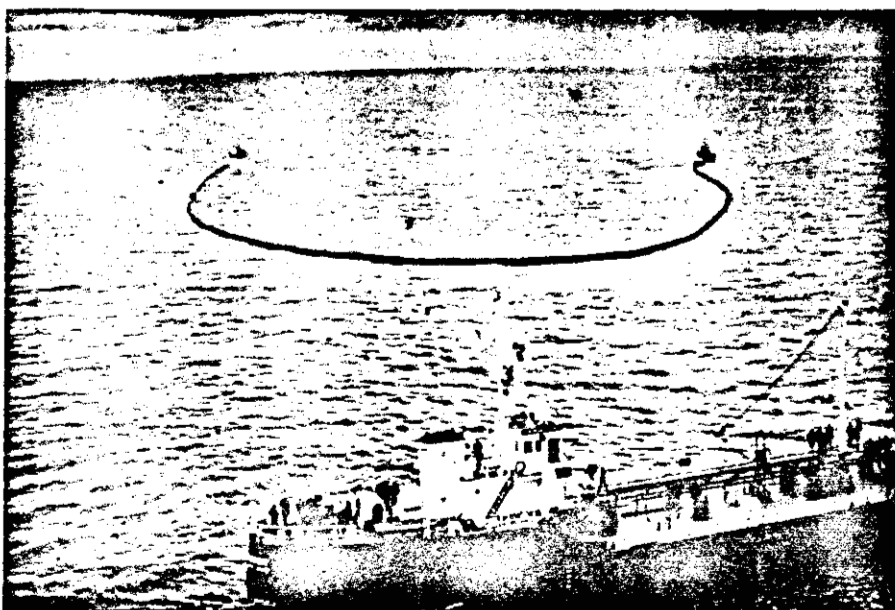


SLIDE - PHOTO 5.  
VIKOMA SEA PACK CONTAINMENT BOOM

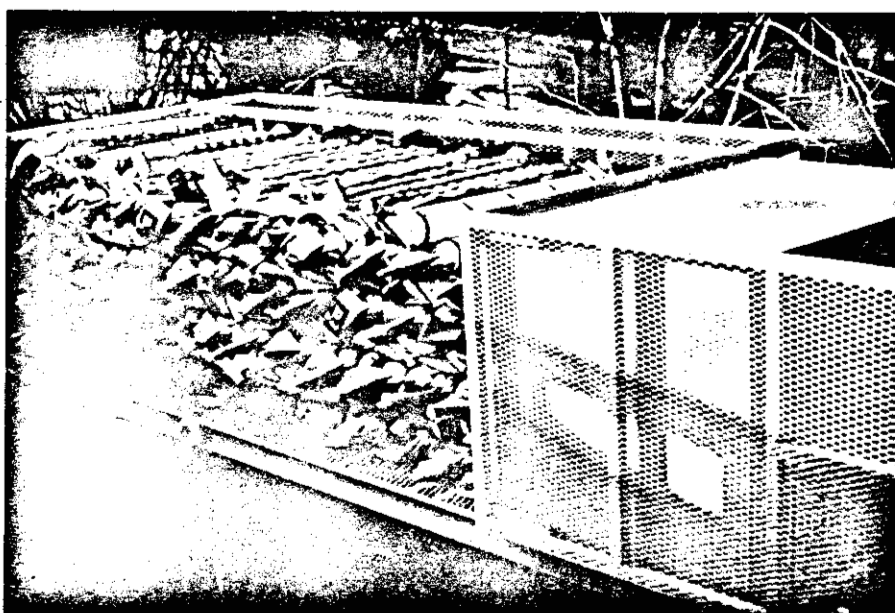


SLIDE - PHOTO 6.  
VIKOMA SEA PACK CONTAINMENT BOOM

ATTACHMENT "A"

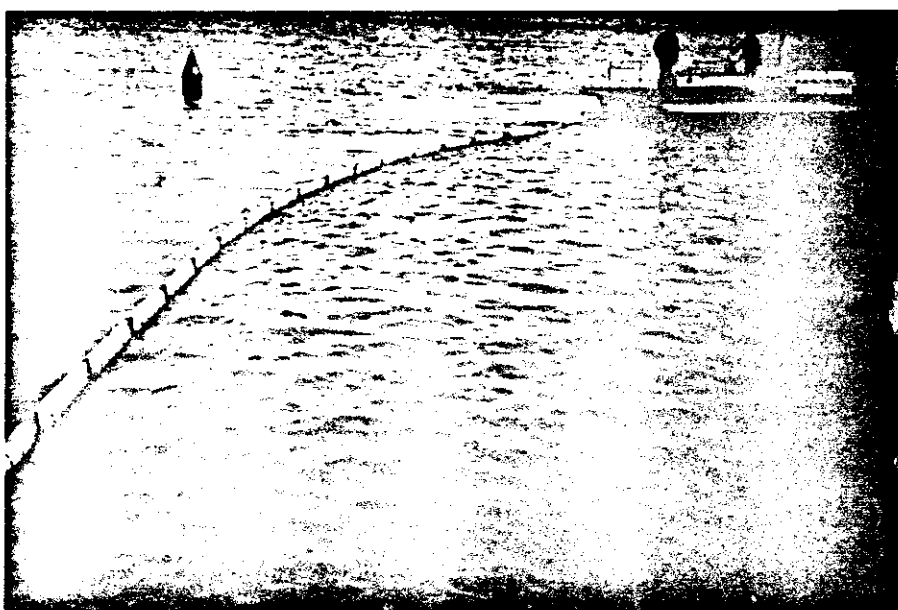


SLIDE - PHOTO 7.  
VIKOMA SEA PACK CONTAINMENT BOOM

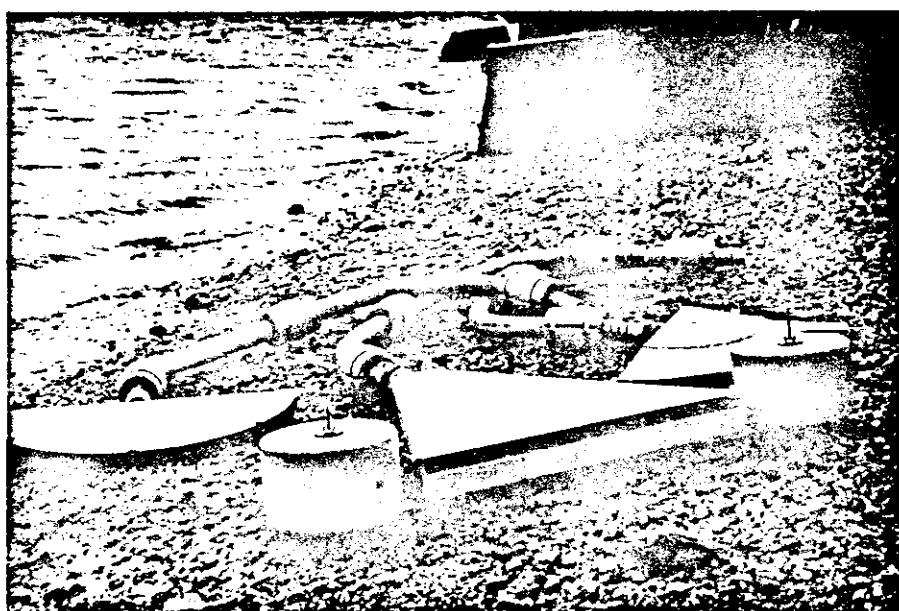


SLIDE - PHOTO 8.  
CONTAINMENT BOOM IN STORAGE TRAILER

ATTACHMENT "A"

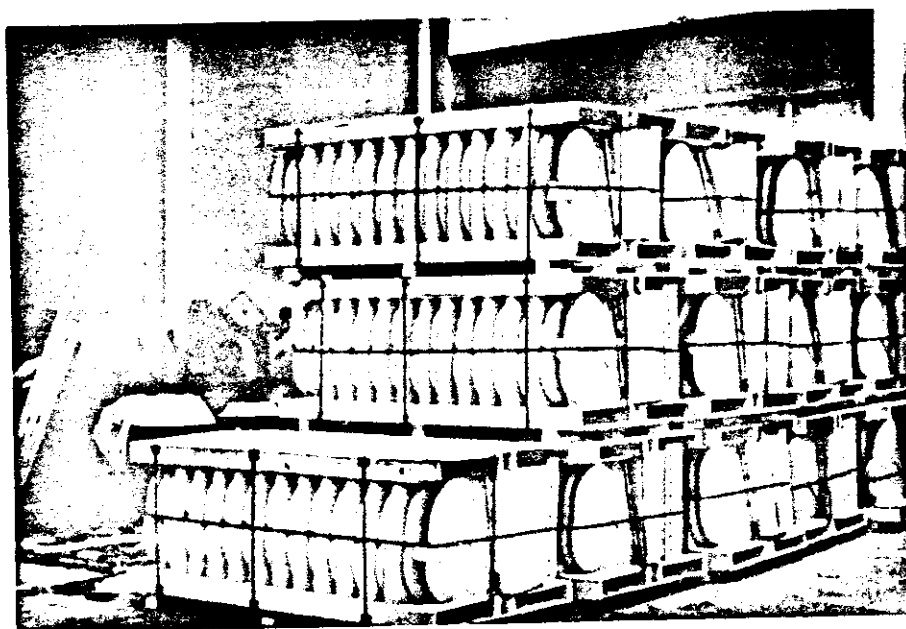


SLIDE - PHOTO 9.  
CONTAINMENT BOOM DEPLOYED

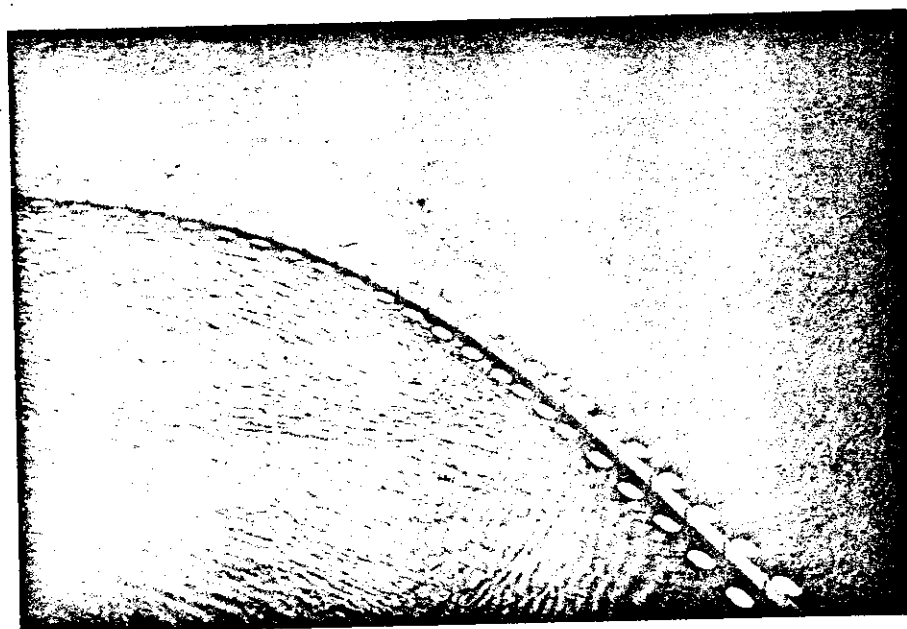


SLIDE - PHOTO 10.  
FLOATING SKIMMERS

ATTACHMENT "A"



SLIDE - PHOTO 11.  
CONTAINMENT BOOM IN STORAGE BOXES

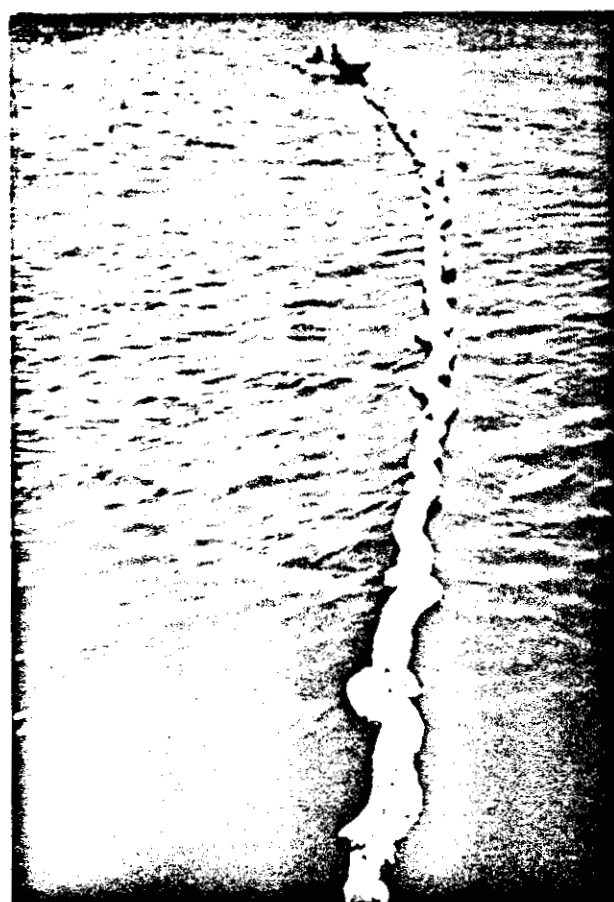


SLIDE - PHOTO 12.  
CONTAINMENT BOOM DEPLOYED

ATTACHMENT "A"

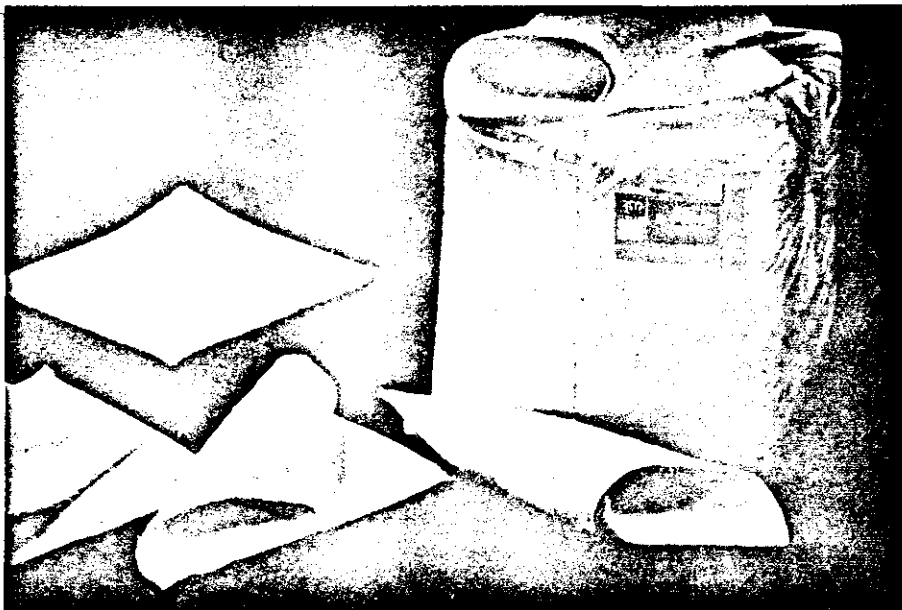


SLIDE - PHOTO 13.  
SORBENT BOOM



SLIDE - PHOTO 14.  
SORBENT BOOM DEPLOYED

ATTACHMENT "A"



SLIDE - PHOTO 15.  
SORBENT SHEETS

STATEMENT OF  
EDWARD W. MERTENS, CHAIRMAN  
AMERICAN PETROLEUM INSTITUTE COMMITTEE ON  
FATE AND EFFECTS OF OIL IN THE ENVIRONMENT  
BEFORE  
THE U.S. DEPARTMENT OF INTERIOR  
BUREAU OF LAND MANAGEMENT HEARING  
ON  
ENVIRONMENTAL IMPACT OF PROPOSED OIL AND GAS  
LEASING--OUTERCONTINENTAL SHELF, GULF OF ALASKA  
(OCS SALE NO. 39)  
AUGUST 12-13, 1975  
ANCHORAGE, ALASKA

MR. CHAIRMAN:

My name is Edward Mertens. I am employed as a chemist by Chevron Research Company, a research subsidiary of the Standard Oil Company of California. During my career, which extends back to the close of World War II, I have held a number of scientific and research management assignments concerned with research work on the heavier fractions of crude oil and the many products derived from these fractions. I hold over 20 U.S. and foreign patents and have written a number of technical articles based on this work. These heavier fractions, incidentally, tend to persist longer after a typical oil spill.

Ten years ago my work began to involve the environmental and health aspects of these products. For the past six years, I have devoted full time to work on environmental problems. As the primary duty of my current assignment, I am Chairman of the American Petroleum Institute's Committee on the Fate and Effects of Oil in the Environment.

API initiated a comprehensive research program on the fate and biological effects of oil spills five years ago. The total cost of this program to the industry is well over a million dollars each year. I expect that this level of support will continue for at least the next several years.

Our program has already yielded a wealth of information. More than 40 papers either have been written or are in preparation by those investigators we have sponsored at

various universities and research organizations. Ultimately, this information will be an important contribution to the large body of literature pertaining to the fate and effects of oil in the marine environment.

Perhaps the most serious problem concerning the potential effects of oil on marine life was whether oil, once taken up by a marine organism, would be permanently retained by that organism and, if so, whether the oil would become concentrated as it moves up the food chain. If this were true, in time the oil would reach some member of the food chain that is used by the human race as part of its diet. Thus, it might constitute a threat to human health. This hypothesis has been advanced by literally scores of authors in their reports, reviews, environmental impact statements, research proposals, and similar writings that are concerned with the effects of oil on marine life. However, as my testimony today will show, these concerns have no valid scientific basis because extensive research shows that oil does not permanently enter the food chain.

This hypothesis is based largely on a study conducted by Blumer following a spill of No. 2 fuel oil in Buzzard's Bay, Massachusetts, in 1969<sup>1</sup> and his subsequent conclusions.<sup>2</sup> Blumer analyzed oysters exposed to this spill and found they had taken up oil fractions. He kept three of the exposed oysters--only three--in flowing seawater in his laboratory. One oyster was analyzed for its oil content after 72 days;

the other two after 180 days. Concerning this work he states, "Oysters that were removed from the polluted area and that were maintained in clean water for as long as six months retained the oil without change in composition or quantity. Thus, once contaminated, shellfish cannot cleanse themselves of oil pollution."<sup>1</sup>

My previous testimonies given at hearings sponsored by the Department of the Interior in Corpus Christi, Texas, last September<sup>3</sup> and in Beverly Hills, California, last February<sup>4</sup> cited nearly a dozen references<sup>5-15</sup> that refute Blumer's conclusion. Every reference reports that once an exposure to oil has passed, the amount of oil in the organism had either returned to, or closely approximates, the original background level. Release occurs rapidly at first, but in a few instances, as much as 6-8 weeks may be required before the last traces may no longer be detectable.<sup>16,17</sup> Further, this conclusion, namely, that oil is released quickly and either nearly or completely quantitatively, is corroborated by additional publications that have appeared in recent months.<sup>17-23</sup>

Even Blumer's data do not bear out his conclusion cited above. If one compares closely the concentration of oil he found in the oyster tissues after being held in the laboratory for six months<sup>1</sup> with the concentration of oil in the tissue found at the beginning of the depuration experiment,<sup>24,25</sup> the average content of oil per 100 grams of tissue are 3.8

and 6.9 milligrams, respectively. Even by his data, he shows a release of almost 50%, rather than none as he states in his conclusion. He claims that the oil quantities in the tissues before and after the experiment are in good agreement, especially if allowance is made for the apparent dilution of oil by growth of the oysters during the course of the experiment. His data show that the average gain in weight per animal was barely 5%. If the decline was attributed solely to dilution by growth, the average content of oil per 100 grams of tissue should have declined from 6.9 milligrams to 6.6 milligrams rather than 3.8 milligrams.

Thus, I am not aware of any reference in the literature--not even Blumer's work--that support his contention that oysters or any other marine organism retain whatever oil they have accumulated without change in composition or quantity once their exposure to oil has been terminated. On the contrary, every reference concerning uptake and depuration research that I have seen shows that marine organisms depurate once an oil spill episode or a simulated spill has passed.

Indeed, this conclusion is shared by the Energy Policy Project of the Ford Foundation,<sup>26</sup> the National Academy of Sciences,<sup>27</sup> and the Marine Technology Society.<sup>28</sup>

These results which I have just summarized strongly refute the previously mentioned hypothesis which has been adopted widely by the critics of our industry. Since marine organisms subjected to an oil spill do not retain oil permanently,

we feel that it is highly unlikely that such contamination becomes concentrated by transfer from one trophic level to the next through the food chain. Thus, the possibility of transfer of harmful oil fractions by this mechanism so that they become a threat to human health becomes extremely remote or, more likely, nonexistent.

These latter conclusions are supported by research conducted both in the laboratory and in the field.

The question of magnification of hydrocarbon concentrations occurring from transfer up the food chain was investigated by Cox<sup>7</sup> and J. W. Anderson.<sup>8</sup> Neither investigator found any evidence of magnification. Their observations agree with those of Straughan, who found no evidence of biomagnification in her recently completed two-year study of the marine community exposed to the natural oil seeps near Santa Barbara.<sup>29</sup> Burns and Teal found no relation between the hydrocarbon content of an organism and its position in the food chain in their study of the Sargasso Sea community.<sup>30</sup> Thus, neither laboratory work nor field studies support the contention of the industry's critics that the concentration of oil increases as it progresses through the food chain.

Exposure at sublethal concentrations of oil has shown no effect on growth rate of marine organisms. This conclusion was reached by R. D. Anderson<sup>6</sup> and Cox<sup>7</sup> in their research on oysters and shrimp, respectively. Their conclusions agree

with those obtained by Mackin and Hopkins,<sup>31</sup> who found no difference in the growth rate between oysters growing in an area subjected to oil contamination and that of control oysters in an uncontaminated area. Nor did Straughan, in her work supported by API, find that the natural oil seeps near Santa Barbara affected the growth rate of marine organisms living in the area.<sup>29</sup> More recently, these results are confirmed by Battelle-Northwest studies at Lake Maracaibo, Venezuela. There they exposed lisa, a fish native to that area, for 11 weeks to Tia Juana Medium crude oil.<sup>32</sup> No effect on growth rate was observed. Since growth rate integrates many life processes and physiological factors, we are encouraged by those results. Part of our research program is directed toward studying more extensively the potential effects of exposure of marine life to sublethal concentrations.

It is widely believed by the public that whenever an oil spill of any reasonably large magnitude occurs, the aftermath is a major devastation of marine life. Further, the public is conditioned to believe that this devastation will persist for an extended period of time. Most of my remaining comments today will provide information that will show these beliefs are inaccurate insofar as all but the most severe spills are concerned.

A comprehensive survey of more than a hundred major spills that occurred throughout the world over a 12-year period (1960-1971) was made by Ottway.<sup>33</sup> An analysis of the data

from this survey revealed that birds represented the type of marine life most often significantly affected. In less than 25% of the spills were more than 50 birds involved. For other forms of marine life where damage could be described as extensive, the incidence was even less.<sup>34</sup> These levels are probably low because some of the spills may not have been adequately reported. Nevertheless, only a small number of spills, most notably the West Falmouth and the Tampico Maru spills, resulted in significant damage lasting a year or more. The latter spill, incidentally, occurred near Baja California in Mexico in 1957. Comparable damage resulted from the Torrey Canyon spill, but it is generally acknowledged that this damage resulted primarily from the use of improperly formulated dispersants applied in an improper manner rather than from the effect of the oil itself. All three of these spills occurred near shore.

On the other hand, spills from offshore platforms have been relatively rare. Of the 19,000 wells drilled in our continental waters over the past 25 years, only the Santa Barbara spill reached the beach in a quantity that required extensive cleanup. Its effect on marine life was slight and temporary.<sup>35</sup> Only two other significant platform spills have occurred.<sup>36,37</sup> Coincidentally, both of these were in the Gulf of Mexico in 1970. One of these was studied extensively to assess its environmental impact. Its damage

to marine life was inconsequential.<sup>36</sup> By all standards, this record of the offshore industry is impressive.

The factors that are responsible for the wide variations in the environmental effects of oils spills are identified by McAuliffe.<sup>38</sup>

He observes that three conditions are especially critical; and for a spill to have significant environmental damage, all three conditions must exist simultaneously. These conditions are:

1. The oil must be spilled into a confined body of water, such as a small bay. Thus, the volume of oil spilled is large with respect to the body of water being impacted.
2. The oil should be a refined oil, such as No. 2 fuel oil.
3. Storms or heavy surf must cause the spilled oil to be churned into the bottom sediments.

Indeed, all three conditions did exist in the case of the two spills, the West Falmouth and the Tampico Maru spills, in which significant damage attributed to the oil itself persisted beyond a year or two. In each case, the oil spill involved a No. 2 fuel oil, which was confined in a small area of shallow water for several days. Storms and/or heavy surf caused the oil to be churned into the bottom sediment.

In contrast, offshore platforms are almost without exception located in unconfined areas and in reasonably deep waters. Thus, the first condition outlined by McAuliffe can rarely be met. Secondly, a platform produces crude oil, which is substantially less toxic than most refined oils. Thirdly, in such deep waters, storms and heavy surf rarely, if ever, are able to churn oil into the sediments. Thus, the absence of all three factors minimizes the risk to the marine ecosystem.

Moreover, it must be remembered that since platforms are usually located well offshore, substantial changes in the character of the spilled crude oil will occur before it reaches the nearshore zone, which is the most biologically vulnerable area. Once oil is spilled, there is time for the lighter oil fractions to evaporate. Within a matter of hours, components of crude oil as heavy as gasoline have escaped into the atmosphere.<sup>39,49</sup> These fractions are generally acknowledged as the most toxic fractions. This conclusion is confirmed by work conducted by Battelle-Northwest at Lake Maracaibo, Venezuela. They demonstrated that after only two hours' weathering, the toxicity of the oil to shrimp had dropped substantially.<sup>32</sup> This drop correlated closely with an attendant drop in concentration of light aromatics in the water column.

There is time also for many of the components of the crude oil to be dispersed or, for some components, to be dissolved

in the water column. Subsequent dilution rapidly reduces their concentration to far below toxic levels. Further, their presence in the water column is often short-lived because many components partition readily from the water into the atmosphere.<sup>41</sup> And, finally, if a spill should threaten a nearshore zone or shoreline, there is time for cleanup equipment to be placed in operation.

The public has also expressed concern about chronic pollution of the oceans by oil that may occur from increased offshore drilling. They envision that the amount of oil entering the oceans will be substantial and that, consequently, the quantity and diversity of marine life will gradually diminish to a small fraction of the current level. My remaining comments today will point out that the day-to-day operation of additional offshore platforms will impose, at most, a very small incremental burden of oil to the oceans of our world.

Estimates of the quantities of oil that enter the oceans annually from various sources have been developed by the National Academy of Sciences.<sup>27</sup> Of the estimated six million metric tons that reach the oceans throughout the world each year, nearly 80% comes from river and urban runoff, municipal and industrial waste discharges, and marine transportation. About 10% comes from natural seeps and another 10% from atmospheric fallout. The contribution from offshore production is 1.3%.

Thus, the contribution of oil to marine waters from offshore production relative to the overall amount can be considered minimal if not negligible. With respect to the amount that comes from natural oil seeps, offshore production contributes only one-eighth as much. Significantly, even if we doubled the number of wells in our outercontinental waters, their total contribution to marine waters would be still a small fraction and would be only one-fourth of the amount that comes from natural oil seeps. This comparison is especially significant for the purposes of this hearing in view of the many natural seeps that are known to exist along the Gulf of Alaska shoreline.<sup>42</sup> Undoubtedly, many other seeps exist in the deeper waters of the Gulf that have not been observed.

In summary, we are convinced that oil poses far less of a threat to marine life than has been popularly believed. There is no evidence that oil is passed through the food chain and thereby becomes concentrated so that eventually it becomes a health hazard to man. Major oil spills from offshore platforms have been a rare occurrence to date. Those who oppose offshore drilling frequently express the fear that if a major spill should occur, it will have a devastating effect on marine life. This fear is unfounded, for out of more than 19,000 wells drilled in offshore waters so far, there has never been a spill where such devastating effects have taken place. Indeed, in only one spill has any

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measurable damage occurred; and its extent was inconsequential. And, finally, even if we doubled the number of offshore wells, the added input of oil from such operations would add little more than 1% to the oil that now enters the marine waters annually.

Our Committee is convinced that by taking proper precautions that employ technology presently available, the added risk is extremely small. This conclusion is confirmed by the excellent record of the offshore industry since its beginning more than 25 years ago.

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